BIDIRECTIONAL ASSOCIATIONS BETWEEN SOCIAL MEDIA USE AND PSYCHOPATHOLOGY

by

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Abstract

Social media platforms, such as Instagram and Facebook (IG/FB), are central to communication and relationship development among emerging adults. This phenomenon raises concerns regarding how the use of this technology might be related to the psychopathology of those who use it. Existing longitudinal work has largely focused on how social media predicts psychopathology, with less attention on how psychopathology might also predict the way we engage with social media. Further, we know little about whether the type of psychopathology (e.g., internalizing versus attention/deficit hyperactivity disorder (ADHD) symptoms), or the type of social media use (e.g., quantity, behaviours, and quality) matter for these associations.

Using a short-term longitudinal design, the current study investigated the bidirectional associations between dimensions of IG/FB use and aspects of psychopathology (internalizing symptoms and ADHD symptoms) in a sample of 399 emerging adult users of IG/FB with elevations in psychopathology symptoms and perceived their social media use to have some negative impact on their lives. I also investigated the potential role that quality and quantity of IG/FB use might play in mediating associations between internalizing psychopathology and ADHD symptoms. Self-reported psychopathology and IG/FB use were assessed every 2 weeks for a total of 6 weeks. Similarly, participants’ IG/FB pages were observationally coded every 2 weeks for a total of 6 weeks.

Findings indicated that higher quantity of IG/FB use predicted more internalizing symptoms 2 weeks later. Higher quality IG/FB use also predicted subsequent increases in both internalizing psychopathology and ADHD symptoms. More internalizing symptoms at a previous timepoint was associated with greater engagement in upward social comparisons at subsequent timepoints. I found that higher internalizing psychopathology was bidirectionally
associated with increased engagement in social comparisons, and vice-versa. Neither quantity nor quality of IG/FB use mediated associations between internalizing psychopathology and ADHD symptoms. I note that my findings may not generalize to individuals who are not elevated in psychopathology symptoms or do not perceive their IG/FB use to have a negative impact on their lives and may not speak to experiences on other social media.
Lay Summary

The rise in popularity of social media platforms like Instagram and Facebook (IG/FB) in the lives of emerging adults has led to questions around how the use of these platforms might be associated with psychopathology. It is also unclear what role social media might play in how one form of psychopathology might predict the development of other mental health difficulties. This longitudinal study investigated how different dimensions of IG/FB use and aspects of psychopathology might be related to each other over time. Results indicate that greater quantity of IG/FB use predicted increases in internalizing symptoms. Higher quality of IG/FB use was also linked to increases in internalizing psychopathology and ADHD symptoms. Higher internalizing psychopathology also predicted more negative social comparisons on IG and FB. Interestingly, we found higher internalizing psychopathology predicted more social comparisons, and vice-versa, over time.
Preface

This study was approved by the UBC Behavioural Research Ethics Board (H19-01493). All work for this dissertation was conducted by myself (Adri Khalis) under the guidance of Dr. Amori Mikami, who is my supervisor and the principal investigator of the Peer Relationships in Childhood Lab. I designed the study and collected the data with the help of my research assistants (whom I trained on the research protocol). I conducted all data analysis and writing of the dissertation.
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Dedication

This dissertation is dedicated to many people in my life, but to three most of all. First, to my late father, Abdul Karim. I wish you were here to see what I’ve accomplished; I hope I made you proud. Second, to my mother, Hamidah Alias, who instilled in me the importance of curiosity, education, and kindness. Lastly, to my wife, Mikayla Pachkowski, who is a daily reminder of what matters most in life.
Introduction

Social media such as Instagram (IG) and Facebook (FB), which are online platforms that facilitate social interactions, relationships, and self-presentation, have become increasingly entrenched in how people communicate. The proliferation of social media, particularly among emerging adults, has led to concerns about how this technology may affect, and be affected by, users’ psychopathology (Haidt, 2023; Pantic, 2014). Given that associations between psychopathology and in-person social functioning appear to be bidirectional (Hames et al., 2013), it is important to understand how psychopathology might relate to functioning in the online social context.

The current study, involving a short-term longitudinal design with emerging adult participants (who reported elevations in psychopathology and perceived at least some negative impact of social media use on their lives), advances the existing literature in three areas. First, previous research has predominantly focused on how social media use might predict psychopathology, with much less focus on how psychopathology might predict social media use. Therefore, I examined the bidirectional associations between IG/FB use and psychopathology. Second, most available literature on social media has concerned the quantity (e.g., amount, frequency, or intensity) of social media use, despite assertions that multi-dimensional aspects comprise users’ experiences on these platforms (Khalis & Mikami, 2018). The present investigation considered not only IG/FB users’ quantity of use but also the types of behaviours in which they engage and the quality of their social experiences on these platforms. Lastly, we know little about how different forms of psychopathology, such as attention-deficit/hyperactivity disorder (ADHD) versus internalizing symptoms, might be uniquely related to IG/FB use. This contrasts with our understanding of the distinct associations between these forms of
psychopathology and in-person social functioning. In the current study, I explored how ADHD and internalizing psychopathology differentially relate to social media use. This dissertation was part of a larger study aimed at changing the behaviours of IG/FB users who are elevated on internalizing and/or ADHD symptoms, with the goal of increasing users’ well-being. Of note, the majority of participants in our sample were cis-gender women.

This introduction begins with a brief overview of social media. I then discuss the similarities and differences between social media and the in-person social context, as this has implications for understanding how psychopathology might play out in online social environments. Next, I outline the distinct dimensions of IG/FB use: the quantity of use, the behaviours in which users engage, and the quality of users’ social experiences and relationships. Following this, I present the current understanding of how ADHD and internalizing symptoms might each uniquely relate to in-person social functioning to anticipate how these patterns may translate into the online domain. Lastly, I summarize research on the associations between ADHD and internalizing symptoms with IG/FB use and articulate my rationale for the potential bidirectional relations between these psychopathologies and aspects of IG/FB use. In addition, I discuss the potential for IG/FB use to mediate the associations between ADHD symptoms and internalizing psychopathology.

**Overview of Social Media**

Social media or social networking sites broadly refer to online websites, applications, or platforms that allow users to create personalized profiles, share interactive content, and communicate with others (Ellison & boyd, 2013). These platforms are an example of "web 2.0", a new generation of online web services that emphasize user-generated content, where users contribute to the content in addition to consuming it. This stands in contrast to first-generation
"web 1.0" websites and applications, where users could only passively view and consume already-published content (O’Reilly, 2005). Thus, social media has given birth to a new form of engaging with the internet by allowing users to actively communicate, share, and connect with others regardless of geographical distance.

Although social media and social networking sites having existed since the late 1990s, their use grew exponentially after the launch of FB in 2006. Since then, other forms of social media offering different features and experiences have emerged (e.g., Twitter, Youtube, Instagram, Snapchat, TikTok). Although each platform is distinct, all allow users to create and share self-generated content, typically in the form of text posts, images, or videos. Users can alter and enhance their images and videos. Recent developments on these platforms allow users to post "Stories", which are images or videos that vanish after 24 hours. This feature further encourages users to share moments in their day-to-day lives.

Social media has become entrenched in the way we communicate and maintain relationships. Approximately 94% of Canadian adults who are online report having at least one social media account (Gruzd et al., 2018), with people aged 18-29 being the most frequent adult users of social media (Perrin & Anderson, 2019). As the popularity of social media has grown, concerns have been raised regarding the impact of this technology on users’ mental health (Pantic, 2014). In fact, researchers ponder whether there are experiences unique to social media that maintain or exacerbate users’ psychopathology (Holmgren & Coyne, 2017; Sampasa-Kanyinga & Hamilton, 2015). Below, I discuss ways in which the social media context may be similar to and different from in-person social contexts, to provide a framework for understanding how psychopathology might play out in this relatively new social environment.
Similarities and Differences between Social Media and the In-Person Social Context

Cross-Context Continuity Perspective

Some researchers argue that there is cross-context continuity in social functioning (Mikami & Szwedo, 2016), such that people’s behaviours, relationships, and experiences online may reflect these same constructs in in-person contexts, at least in part. This conceptualization fits with co-construction theory, which postulates that users of online media are not merely passive consumers on these platforms, but that they perpetually co-construct their social environments through the interactions in which they engage (Subrahmanyam et al., 2006). Thus, it has been hypothesized that social media is a new social context for individuals to enact and display some of the same experiences and behaviours as they do in in-person contexts.

In support of the cross-context continuity perspective, studies find that adolescents who are bullied in in-person contexts are more likely to be victimized in online contexts as well (Olweus, 2012) and that undergraduate students who displayed greater involvement on FB were also observed to have better peer relationships in in-person settings (Khalis & Mikami, 2018). The significant overlap in users’ in-person and online social networks may facilitate similar social patterns occurring in the two contexts (Subrahmanyam et al., 2008). Taken together, this perspective suggests that users’ social functioning on social media may parallel their in-person social functioning, at least in some ways.

Transformation Framework

The transformation framework, as proposed by Nesi et al. (2018), suggests that features unique to social media environments can change users’ experiences in ways distinct from in-person contexts. For example, unlike interactions in in-person environments, online social interactions are asynchronous, meaning that users are not always expected to respond right away.
and can take time to craft what they would like to convey. Individuals who struggle in in-person contexts, either because they have difficulties regulating their social behaviours or who avoid interactions due to anxiety over their performance in such interactions, could potentially leverage the asynchronicity of social media to provide them more time and control over their presentation to others. The lack of cues such as vocal tone, gestures, and facial expressions in social media interactions may help socially anxious individuals feel more comfortable (McKenna et al., 2002). On the other hand, without the aid of audiovisual cues, communication on social media can also be more easily misconstrued and misinterpreted. In addition, the emphasis on visual self-presentation on social media platforms may reinforce the posting of content that presents users in a positive light (Dorethy et al., 2014). Thus, people may display different patterns of communicating and interacting when online compared to when in-person.

Rather than viewing these theoretical frameworks as in opposition to each other, I view them as complementary. That is, we may expect some experiences and behaviours to be consistent across online and in-person contexts. Other aspects of social functioning may be transformed or shaped by the social media context. Thus, it is important to clarify under what circumstances social functioning on social media such as IG and FB may be similar to in-person contexts, relative to when it may be dissimilar due to the unique characteristics of the online context. To answer this question, I distinguish between three key aspects of IG/FB use.

**Dimensions of IG/FB Use**

Much like what occurs in-person, experiences on IG and FB are multi-faceted. They can be understood in terms of the quantity of use, the types of behaviours in which users engage, as well as the quality of users’ experiences or interactions.
**Quantity of IG/FB Use**

Quantity refers to the amount of time users spend on social media such as IG and FB, their frequency of use, the size of their social networks, and the number of interactions they have (Ellison et al., 2007; Khalis & Mikami, 2018). This construct has also been referred to as social media intensity, or the intensity with which these platforms are used to form and maintain social relationships (Dunbar, 2016). This dimension of IG/FB use may resemble quantitative aspects of people’s in-person social functioning, such as the number of interactions individuals have, the amount of time they spend on such interactions or their number of friends.

Available research on IG and FB has predominantly focused on the quantity of use. I argue that merely examining the quantity of use is insufficient for understanding people’s experiences on these platforms. At first glance, a large number of friends or followers online may signal that an individual is well-adjusted socially. However, given the ease with which users can add people to their social network or follow others, large online social networks could consist of strangers or acquaintances with whom a person rarely interacts. Similarly, we might assume that more time spent on IG/FB suggests that a person is using that time to develop or maintain social relationships. However, given that platforms like IG and FB also serve nonsocial functions (e.g., reading the news, viewing others’ profiles without interacting with them, or browsing memes), this assumption may be inaccurate. In other words, someone may use IG/FB a lot but have poor quality relationships (or no meaningful relationships) with others online. Thus, it is vital to understand not only the amount that people use IG/FB, but also the types of behaviours in which they engage and the quality of their social experiences and relationships on these platforms.
IG/FB Behaviours

IG/FB behaviours refer to the behaviours in which users engage on IG and FB. Such behaviours are often affect-neutral (which distinguishes them from the quality of social experiences online), even if they may have downstream implications for the quality of IG/FB experiences. I also assume there are individual differences between users in the amount they engage in different IG/FB behaviours. The construct of IG/FB behaviours is akin to in-person social behaviours, examples of which could be social comparison or impression management (Harter, 2012). Although there are many possible IG/FB behaviours, two that have been examined considerably in the literature are online social comparisons and passive IG/FB use.

Online Social Comparisons. The social comparison theory purports that people are driven to evaluate their opinions and abilities by comparing themselves to similar others (Festinger, 1954). This behaviour may function as a means of assessing one's relative social standing (Festinger, 1954), for self-enhancement or improvement (Wood, 1989), and as a coping strategy to regulate emotions (Wood et al., 1985). Within in-person contexts, the impact of social comparison on well-being may depend on the direction of comparison. Upward social comparisons, where individuals compare themselves to others whom they perceive as superior to them, have been associated with lower self-esteem (Tesser et al., 1988), greater body dissatisfaction (Engeln-Maddox, 2005), and the exacerbation of psychopathology (McCarthy & Morina, 2020). Downward comparisons with others we perceive as less accomplished or functioning worse, have been linked to greater feelings of self-worth (Gibbons, 1986) and improved mood (Giordano et al., 2000).

The emphasis on the visualness of content, the quantifiability of social metrics, and the availability of posts and photos from others in our social network may engender a greater degree
of social comparison than in in-person contexts (Nesi et al., 2018). For example, de Vries and Kühne (2015) found that using FB more frequently and for greater durations was associated with engaging in more social comparison. Cramer et al. (2016) also found that 69% of participants reported engaging in social comparison on FB. Further, because social media allows users to craft the content they present, self-presentation on these platforms tends to be curated and positively biased, resembling “highlight reels” (Lup et al., 2015). The constant exposure to this idealized content may lead users to believe that their peers are living better and more exciting lives than they are (Steers et al., 2014), which could increase upward comparisons.

**Passive IG/FB Use.** Active IG/FB use refers to direct communication or interaction with one’s online social network, such as posting photos and status updates, commenting, or sharing content. In contrast, passive use reflects a style of consuming content on social media like IG and FB without interacting with others (e.g., scrolling through news feeds and viewing other people’s content without commenting on it; Valkenburg et al., 2022). Existing literature finds that passive use occurs 50% more than active use on FB (Verduyn et al., 2015) and, concerningly, is linked to lower well-being (Verduyn et al., 2017). Some preliminary work has pointed to social comparison behaviours or envy to explain this association. Using an ecological momentary assessment method, Verduyn et al. (2015) found that within a sample of undergraduate students, passive FB use led to declines in affective well-being through increases in feelings of envy towards others. Another study found that in adolescent boys (but not girls), passive FB use predicted greater body dissatisfaction through increased social comparisons (Rousseau et al., 2017).

**Quality of IG/FB Use**

Quality refers to the affect or valence of users’ experiences on IG and FB or of their
relationships with others on these social networks. Within in-person contexts, interactions and relationships are often characterized based on the amount of positivity (e.g. connectedness and positive affect) and negativity (e.g. conflict and victimization) in them (Parker & Asher, 1993). Similarly, peer acceptance or rejection in in-person contexts may also reflect the overall positive or negative perceptions of, and potentially relationships with, the peer group at large (Gifford-Smith & Brownell, 2003). In in-person contexts, positive and negative features of interpersonal relationships are not simply opposites on the same spectrum. Rather, someone could have both high positive and high negative features in a friendship (or to have neither positive nor negative features) or, conversely, be both liked and disliked by the peer group at large (or be neither liked nor disliked; Gifford-Smith & Brownell, 2003).

Similar to how we conceptualize the quality of in-person social functioning (Hartup, 1995; Whitbourne et al., 2009), users’ experiences, interactions, and relationships on IG and FB are suggested to be understood in terms of their degree of positivity and negativity (Khalis & Mikami, 2018). The quality of people’s IG/FB interactions has been found to contribute to adjustment, much as it does in in-person contexts. Conflict and victimization on social media like FB have been linked to more depressive symptoms (Landoll et al., 2015; Rosenthal et al., 2016), whereas feelings of connectedness to others on FB have been linked to greater well-being (Grieve et al., 2013).

**Measurement of Dimensions of IG/FB Use**

The vast majority of the extant work relies on self-report measures of IG/FB use, including some measures that consist of only one or two items (Frost & Rickwood, 2017; Sarmiento et al., 2020). Self-report measures can introduce recall and social desirability bias (Althubaiti, 2016) and increase the potential for findings to be driven by shared rater variance.
The use of single or double-item scales may not adequately represent the complexity of social media constructs and compromise the reliability of the instrument in question (Robinson, 2018). Consequently, there have been calls in the field for observational or multi-rater measures of IG/FB use in order to draw more reliable conclusions. I attempted to address this measurement limitation in the current study.

**Psychopathology and In-Person Social Functioning**

The rising ubiquity of social media like IG and FB has coincided with concerns about how this form of technology might predict and be predicted by psychopathology, particularly within emerging adult populations who are active IG/FB users. Both ADHD and internalizing psychopathology are relatively common in emerging adults. As I review in the section below, each appears to be associated with poorer in-person social functioning, yet in distinct ways from one another (Canu & Carlson, 2003; Eisenberg et al., 2007; Hames et al., 2013). I consider these in-person patterns because they raise the question of how ADHD and internalizing symptoms may relate to social functioning in the online context.

**Internalizing Symptoms and In-Person Social Functioning**

Internalizing problems encompass the symptoms and diagnoses of conditions such as major depressive disorder, generalized anxiety disorder, and social anxiety disorder. Internalizing difficulties are common, affecting approximately 15% of emerging adults (Eisenberg et al., 2007). Internalizing psychopathology is associated with poorer in-person social functioning overall. This may be particularly salient during the period of emerging adulthood, where individuals experience instability in their social support networks and are forming new peer relationships distinct from those they had in childhood (Arnett, 2000).

In terms of the quantity of relationships, internalizing psychopathology has been linked to
smaller in-person social networks and less contact with others (Libet & Lewinsohn, 1973; Werner-Seidler et al., 2017). Further, anxiety and depressive symptoms may impact the quality of in-person relationships. For instance, within emerging adult samples, internalizing symptomatology has been linked to feelings of lower quality social support and less connectedness in social relationships (Faro et al., 2019; Hefner & Eisenberg, 2009). Regarding in-person social behaviours, interpersonal theories of psychopathology point to specific behaviours and cognitions in which individuals with internalizing psychopathology tend to engage (J. C. Coyne, 1976; Swann et al., 1992), such as social withdrawal and excessive reassurance seeking (Hames et al., 2013).

The in-person social behaviours and experiences associated with internalizing psychopathology may also predict more internalizing psychopathology, showing evidence of a bidirectional relationship. For instance, perceiving experiences as threatening might lead people with internalizing psychopathology to avoid future interactions (Alden et al., 2008; Bouhuys et al., 1999; Plasencia et al., 2011; Tse & Bond, 2004). Excessively seeking reassurance can elicit peer rejection because peers can find this behaviour annoying (Hames et al., 2013). Crucially, the resultant avoidance, rejection, and social withdrawal may limit opportunities to socialize with peers and to participate in normative positive social interactions, which in the long run perpetuates internalizing psychopathology (Hames et al., 2013; Rubin & Burgess, 2001).

**ADHD Symptoms and In-Person Social Functioning**

ADHD is a neurodevelopmental disorder characterized by symptoms of inattention and/or hyperactivity/impulsivity (American Psychiatric Association, 2013). While the emergence of ADHD symptoms occurs before age 12, symptoms typically persist into adulthood (Barkley et al., 2006; G. Weiss & Hechtman, 1993), and the prevalence of ADHD in adults is estimated to be
2.5 to 5.8% (Garnier-Dykstra et al., 2010; Kessler et al., 2006; Vitola et al., 2017). Although the clinical disorder of ADHD is regarded as a lifelong condition that is stable over time, there is evidence to suggest that individuals can also experience fluctuations in levels of symptomatology over shorter time periods (e.g., days and weeks; Schmid et al., 2020). The social difficulties experienced by individuals with ADHD are well documented (Hoza, 2007) and are evident in the emerging adult age group (Shaw-Zirt et al., 2005).

Regarding the quantity of in-person relationships, youth with ADHD (or elevated symptoms) have fewer reciprocated friendships (Hoza, 2007; Murphy & Barkley, 1996) and fewer social ties with other students within their grade level compared to their typically developing peers (Kim et al., 2015). Although research on the quantity of peer relationships in adult samples is limited, Paulson et al. (2005) found that emerging adults reported a lower willingness to interact with new same-age peers who displayed ADHD symptoms, suggesting that adults with ADHD may also have fewer social connections and friendships.

The quality of in-person relationships is also thought to be impacted. Friendships of emerging adults with higher levels of ADHD symptoms evidence fewer positive features (e.g., support) and more negative features (e.g., antagonism and difficulties managing interpersonal conflict) compared to peers with fewer symptoms (McKee, 2017). Higher levels of ADHD symptoms in adults have also been linked to greater feelings of loneliness (Stickley et al., 2017), which could indicate dissatisfaction with either the quantity and/or quality of relationships. However, the in-person social difficulties of individuals with ADHD are thought to be driven by social behaviours distinct from those with internalizing psychopathology. Inattentive symptoms make it hard to attend to social cues crucial to effective peer interactions (Landau & Milich, 1988), which may result in ignoring signals that a peer is bored or failing to pick up on subtleties,
in conversation. Hyperactivity/impulsivity may prevent those with ADHD from regulating their emotions and behaviours (Bacchini et al., 2008), leading them to disrupt others’ interactions or blurt out hurtful comments (Barkley et al., 2006).

As with internalizing symptoms, there is some evidence for a bidirectional pathway between in-person social behaviours/experiences and ADHD symptoms. The social behaviours associated with ADHD may get in the way of making friends (quantity) and friendship quality (McKee, 2017), including in an emerging adult sample (Paulson et al., 2005). Poorer quantity and quality of relationships may then predict increases in symptoms of ADHD, as was found in a sample of school-age children followed over 12 months (Tseng et al., 2014). Another study found that prior victimization from peers predicted more attention problems 3 years later (Ji et al., 2019). These findings align with experimental work in an adult sample where social exclusion and rejection led to impairment in self-regulation processes, manifesting as problems with attention and impulsivity (Baumeister et al., 2005).

**In-Person Social Functioning as Mediating Associations between ADHD and Internalizing Psychopathology**

Comorbidity between ADHD and internalizing psychopathology is relatively common and well-documented across the lifespan, with comorbidity rates in adults ranging from 8–25% (Katzman et al., 2017; Knouse et al., 2013; Meinzer et al., 2014). The co-occurrence of these two aspects of psychopathology is particularly concerning, given that this comorbidity is associated with poorer treatment outcomes and more significant functional impairment (Biederman et al., 2008). Thus, it is helpful to understand potential directional pathways between ADHD and internalizing psychopathology, and vice versa, as well as the mediators of these links.

Available research in in-person contexts suggests that the quantity and quality of social
functioning may play a role in understanding the association between ADHD symptoms and subsequent internalizing psychopathology. Individuals with ADHD often have fewer friends than their typically-developing peers (Blachman & Hinshaw, 2002; Hoza et al., 2005). Research also finds that a lack of reciprocated friendships in childhood is linked to higher depressive symptoms in adulthood (Bagwell et al., 1998). Humphreys et al. (2013) found that poor-quality peer functioning, characterized by greater rejection, mediated the relationship between inattentive symptoms as a child and depressive symptoms at age 20. A cross-sectional study found that adolescents with ADHD who were victimized also reported experiencing more anxiety (Becker et al., 2017). In addition, this same study found that peer victimization was associated with greater depression symptoms in adolescent boys with ADHD but not girls. In contrast, another investigation found that rejection and victimization mediated the association between ADHD symptoms and subsequent depression in girls but not boys (Roy et al., 2015).

Prospective work investigating internalizing psychopathology as a predictor of subsequent ADHD symptoms is limited. However, existing literature suggests that internalizing psychopathology predicts a lower quantity of in-person peer relationships (Werner-Seidler et al., 2017), and a low quantity of in-person peer relationships has, in turn, been found to exacerbate ADHD symptoms in other work (Tseng et al., 2014). In addition, related research suggests that the poor-quality peer experiences precipitated by internalizing problems might exacerbate ADHD symptoms. As discussed above, anxious-depressive symptomatology has been found to predict more experiences of rejection (Gotlib & Lee, 1989). Experiences of rejection, in turn, may cause a breakdown in self-regulatory processes that can lead to higher ADHD symptoms (Baumeister et al., 2005). Thus, with the caveat that existing work has focused on symptoms of inattention and impulsivity rather than the disorder of ADHD, it is plausible that internalizing
psychopathology might predict subsequent ADHD symptoms through the quantity and quality of in-person social experiences.

**Psychopathology and Online Social Functioning**

Whether the known associations between psychopathology and in-person functioning will manifest similarly or differently in the online context is an important question. On the one hand, the cross-context continuity hypothesis suggests that we might see parallels in individuals’ in-person and online social functioning in terms of quantity, behaviours, and quality of interaction patterns. As one example, an individual who tends to have negative peer experiences in-person (involving backstabbing or relational aggression), which could be related to their ADHD symptoms, might show similar interpersonal patterns online (Mikami & Szwedo, 2016). Therefore, we might expect any associations between psychopathology and social functioning to be similar in direction and magnitude across both contexts. On the other hand, the transformation framework suggests that individuals could have quite different social experiences in-person and online, which may then influence how the experiences on these platforms might intersect with psychopathology. The emphasis on visualized, positively-biased content on platforms such as IG and FB has been suggested to increase the likelihood of individuals engaging in social comparisons with peers in their networks in ways that make them feel worse about themselves (Jang et al., 2016).

Unfortunately, the majority of existing work on this research topic has relied on cross-sectional research designs (Valkenburg, 2022), which leaves unclear the temporal precedence or causal influences underlying any associations. In the absence of sufficient high-quality prospective and experimental work, findings from cross-sectional studies can and have been misinterpreted by media and policymakers, leading to fears that digital technology, such as social
media, is harmful to mental health and to calls to curb its use (Orben & Przybylski, 2019). Moreover, the limited longitudinal research that is available has largely focused on how IG/FB use might predict users’ psychopathology (Holmgren & Coyne, 2017; Sampasa-Kanyinga & Hamilton, 2015), as opposed to examining how psychopathology may also predict the way that users engage with IG/FB. However, interpersonal theories of psychopathology would suggest that the associations between IG/FB use and psychopathology may be bidirectional. I speculate that individuals with psychopathology may engage with their online social network in ways that serve to maintain or exacerbate their symptoms.

Examining the reciprocal associations between IG/FB use and psychopathology is important as it portrays IG/FB users as active agents in their online experiences rather than passive consumers of the media available to them. This aligns with the co-construction theory of social media postulated by Subrahmanyam et al. (2006). Explication of reciprocal processes that underlie the associations between IG/FB use and psychopathology will expand on existing interpersonal models of psychopathology by incorporating a new but important social context for individuals: the online social environment.

**Quantity of IG/FB Use and Psychopathology**

Below, I review how the quantity of IG/FB use may relate to internalizing psychopathology and ADHD symptoms. I also explore the evidence for bidirectional pathways (e.g., from psychopathology to IG/FB use and from IG/FB use to psychopathology).

**Internalizing Psychopathology**

Extant cross-sectional literature points to a positive association between internalizing psychopathology and the quantity of IG/FB use, such that more anxiety and depressive symptoms are linked to more frequent and lengthier use of IG/FB (Reer et al., 2019; Sampasa-
Kanyinga & Lewis, 2015; Wright et al., 2013). Given that internalizing psychopathology has been associated with having fewer relationships and interactions with peers in-person, it may be that the unique characteristics of the online environment lead to different manifestations of the interpersonal difficulties associated with internalizing psychopathology. The ease with which users can initiate interactions with others online, fewer social cues online, and the asynchronous nature of communication (where users can take time to compose a response) may make this medium appealing for individuals who otherwise struggle socially in in-person settings due to internalizing psychopathology; this may translate to more IG/FB engagement rather than less (Des Jarlais & Willoughby, 2010).

Examination of the limited research examining the directional pathway from internalizing psychopathology to subsequent quantity of IG/FB use reveals mixed findings. Yoo and Jeong (2017) found that in a sample of adults, more depressive symptoms predicted more time spent on FB 1 year later. Another study revealed that more depressive symptoms predicted more frequent use of social media over time for adolescent girls, but not adolescent boys or emerging adults of either gender (Heffer et al., 2019). In contrast, Feinstein et al. (2012) found no relationship between participants’ internalizing symptoms and the quantity of their social media use 3 weeks later.

Relatively more work has documented the directional pathway from quantity of IG/FB use to subsequent internalizing psychopathology. More self-reported social media use was found to predict increased depressive symptoms the next day (Steers et al., 2014), 6 months later (Brunborg & Burdzovic Andreas, 2019), and 6 years later (S. M. Coyne et al., 2018). Observational work by Seabrook et al. (2018) also found that increased activity on FB predicted more depressive symptoms. In an experimental study, participants who were asked to limit their
daily social media use also reported reductions in symptoms of depression and anxiety 3 weeks later (Hunt et al., 2018). Collectively, preliminary evidence suggests that a greater quantity of IG/FB use is linked to more internalizing symptoms. One potential explanation for this pattern of findings is that using IG/FB more increases social comparison, which in turn exacerbates existing psychopathology. For instance, Steers et al. (2014) found that users who spent more time on FB and logged in more often also engaged in more social comparisons online, which exacerbated internalizing symptoms.

In short, although available evidence suggests that a greater quantity of IG/FB use predicts more internalizing symptomatology over time, the opposite directional pathway (internalizing psychopathology to quantity of use) remains unclear. Another issue with the work examining the directional pathway between quantity of IG/FB use and internalizing psychopathology is that the possibility of the opposite pathway (psychopathology to quantity of IG/FB) is not simultaneously accounted for in analyses.

**ADHD Symptoms**

Cross-sectional studies have found positive associations between the quantity of IG/FB use and ADHD symptoms. Adolescents with more ADHD symptoms reported spending more time on social media (George et al., 2018) and checking their social media more often (Barry et al., 2017) than adolescents with few ADHD symptoms. Similarly, Khalis and Mikami (2018) found that in a sample of emerging adults, higher ADHD symptom levels were correlated with observations of a greater quantity of FB use (e.g. more friends, posts, and likes). These findings also run contrary to research that ADHD is associated with lower (not higher) quantity of in-person peer relationships (Hoza, 2007). As with internalizing psychopathology, the lower barriers for online interactions may make it easy for those with ADHD symptoms to engage. For
instance, instead of arranging an in-person interaction with a peer (which requires planning, organization, and a peer who wants to meet), a high quantity of IG/FB use could simply involve checking one’s phone often or friending or following people with a single click. In fact, the trouble that emerging adults with ADHD have with regulating their behaviours in in-person contexts might manifest as difficulties in modulating the frequency and length of their IG/FB use (Settanni et al., 2018). That is, individuals with ADHD symptoms may find it challenging to suppress the impulse to procrastinate by checking IG/FB or to not be distracted by these apps when they need to study or work. I speculate that this may be why ADHD symptoms may be linked with more quantity of IG/FB use rather than less.

Nonetheless, to my knowledge, only one study has tested the directional pathway from ADHD symptoms to subsequent quantity of IG/FB use. Mikami et al. (2015) found that a childhood ADHD diagnosis predicted fewer (not more) FB friends in emerging adulthood in a sample of women. However, I wonder whether the number of FB friends may not fully reflect quantity of IG/FB use (which also contains constructs such as the amount of time spent checking IG/FB or the frequency of checking IG/FB). The number of FB friends may instead better reflect the size of one’s social network, given the high overlap in the online and in-person friends of emerging adults.

Concerning the directional pathway from the quantity of IG/FB use to ADHD symptoms, one study found that participants who checked their social media accounts more frequently also reported increased ADHD symptoms 24 months later (Ra et al., 2018). The authors suggested that constant access and exposure to the high level of engaging and reinforcing feedback that one receives from IG/FB in the forms of likes and notifications may lead users to expect and be accustomed to the availability of compelling content, thereby increasing users’ distractibility and
disrupting their impulse control. Again, these results run counter to findings in in-person contexts suggesting that lower (not higher) quantity of in-person peer relationships predicts more subsequent ADHD symptoms (Tseng et al., 2014). This may highlight the differences between the in-person and online contexts, as well as potential differences between the constructs of number of friends in-person and the metrics that are typically considered to reflect quantity of IG/FB use (a combination of online friends and time spent on social media). Thus, literature on the bidirectional associations between the quantity of IG/FB use and ADHD is limited and presents an interesting avenue for further investigation.

**IG/FB Behaviours and Psychopathology**

This section discusses associations between psychopathology and IG/FB behaviours. Bidirectional relationships between the two constructs are again considered.

**Internalizing Psychopathology**

There is reason to believe that internalizing psychopathology may be reciprocally related to specific IG/FB behaviours. Reports of more passive IG/FB use and social comparison behaviours have specifically been correlated with more internalizing psychopathology (Feinstein et al., 2013; Shaw et al., 2015).

Longitudinal work finds some support for the directional pathway between internalizing psychopathology and social comparison behaviours; specifically, this was found for depressive symptoms positively predicting users’ engagement in more social comparisons (Nesi et al., 2017; Scherr et al., 2019). To my knowledge, no longitudinal studies thus far have investigated how internalizing psychopathology might be related to subsequent passive IG/FB use.

The directional pathway from IG/FB behaviours to internalizing psychopathology has received more attention. With regard to passive IG/FB use, Frison and Eggermont (2015) found
that passive browsing was related to increases in depressive symptoms 6 months later. Though, results from a separate daily diary study suggested that passive social media use was not a significant predictor of depressive symptoms over 14 days (Aalbers et al., 2019). One study investigating the bidirectional associations of FB behaviours and depression found that neither social comparison behaviours nor passive FB use predicted depression symptoms 1 year later (Scherr et al., 2019). The authors speculated that these experiences and behaviours might be psychologically benign in the long-term. It is possible that the pattern of findings may be different when examining these processes over a shorter time span because other factors may play a larger role in affecting depression over more extended periods.

Further, some prospective evidence suggests that engagement in social comparison behaviours might exacerbate internalizing symptoms. Steers et al. (2014) found that participants engaging in more social comparison behaviours also reported more depressive symptoms across 14 days. Experimental work also showed that participants who were directed to browse their FB newsfeed (where social comparisons are more likely to occur), as opposed to a non-social content page, reported more depressive symptoms; this effect was stronger for those high in social comparison tendency (Alfasi, 2019). In sum, there is partial support for bidirectional associations between social comparison behaviours and internalizing psychopathology, with less prospective work on the associations between passive IG/FB use and internalizing psychopathology.

**ADHD Symptoms**

To date, almost no studies have examined how passive IG/FB use or social comparison behaviours on IG/FB might relate to ADHD symptoms. Notably, in a cross-sectional study, Dawson et al. (2019) reported that teenagers with ADHD in their sample engaged in passive FB
use at similar rates relative to their typically developing peers. I am not aware of any other studies that have measured passive IG/FB use as associated with ADHD symptoms. To my knowledge, no studies (either cross-sectional or longitudinal) have examined social comparison behaviours on IG/FB as related to ADHD symptoms.

It is possible that passive use and social comparison on IG/FB are less relevant behaviours for this population. Within in-person social contexts, the behaviours associated with ADHD (at least, among those with hyperactive/impulsive symptoms) manifest as excesses in negative behaviours such as aggression and disrupting the conversations of others (Gardner & Gerdes, 2015) rather than passivity or withdrawal. Further, individuals with ADHD, including in adulthood, tend to exhibit a positive bias, such that they have overly favorable views of their own competence that do not accurately reflect their actual functioning (Knouse et al., 2005; Lui et al., 2013). As positive bias has been attributed to a lack of awareness of one’s deficits and shortcomings (Emeh et al., 2018), it is possible that emerging adults with ADHD may not engage in downward social comparisons on IG/FB, as they may perceive themselves as functioning better than they actually are. It remains unclear what idiosyncratic IG/FB behaviours might be associated with ADHD, which represents a gap in our current understanding.

**Quality of IG/FB Use and Psychopathology**

The quality of interpersonal experiences on IG/FB may also be associated with internalizing psychopathology and ADHD symptoms. Herein I discuss the potential for bidirectional relationships between quality of IG/FB use and psychopathology.

**Internalizing Psychopathology**

A number of studies using cross-sectional designs have found that participants with higher internalizing symptomatology also had more self-reported and observed negatively-
valenced interactions on IG/FB (Dawson et al., 2019; Locatelli et al., 2012; Parent et al., 2018; Settanni & Marengo, 2015). Barry et al. (2019) also found internalizing symptoms to be associated with more aggression and victimization on social media. Several investigations have found that users who endorsed less internalizing psychopathology also reported greater positivity in their FB interactions (Grieve et al., 2013; Locatelli et al., 2012; Parent et al., 2018) and perceived their relationships on IG/FB to be more socially supportive (Frison & Eggermont, 2015, 2016; Wright et al., 2013).

Regarding the directional pathway from internalizing symptoms to quality of IG/FB use, a longitudinal study revealed that greater internalizing symptomatology predicted more reports of negativity in participants' social media interactions with romantic partners and close friends 3 weeks later (Feinstein et al., 2012). This finding has been corroborated by longitudinal investigations that used observational measures of the quality of FB use (Ehrenreich & Underwood, 2016; Szwedo et al., 2011).

Regarding the directional pathway from quality of IG/FB use to internalizing psychopathology, available work generally suggests that more negativity and less positivity in IG/FB interactions may exacerbate anxious and depressive symptoms. Landoll et al. (2013) found that reports of cybervictimization on FB predicted more severe symptoms of depression and anxiety 6 weeks later. This conclusion was partially supported by Frison et al. (2016), who found that cybervictimization positively predicted subsequent depressive symptoms in those individuals who also perceived less social support from friends. However, in a sample of emerging adults, observations of receiving a greater number of posts from FB friends that suggested a genuine and connected relationship were associated with lower internalizing symptoms 6 months later (Mikami et al., 2019). Collectively, available work has provided
support for both directional pathways (i.e., quality of IG/FB use to internalizing symptomatology; internalizing symptomatology to quality of IG/FB use). However, most studies thus far have only tested one of the two pathways in isolation, with no formal investigations of bidirectional associations within the same model.

**ADHD Symptoms**

Few studies have examined the associations between ADHD symptoms and the quality of IG/FB use. In a cross-sectional study, Khalis and Mikami (2018) found that emerging adults who reported more ADHD symptoms were also observed to have more FB interactions containing verbal aggression, negative emotion, and deviant content. However, the same study found no concurrent associations between ADHD symptoms and the observed positivity of participants’ FB use.

Only one study, to my knowledge, has tested the directional pathway between ADHD symptoms and quality of IG/FB use. A longitudinal study found that women with a childhood diagnosis of ADHD were observed to receive fewer posts evidencing positivity from FB friends as adults (Mikami et al., 2015), and that this association was mediated by in-person social impairment. Children develop important social skills (e.g. emotion regulation, identification of social cues, and perspective-taking) through in-person peer interactions (Pedersen et al., 2007). The rejection faced by children with ADHD in in-person contexts may deprive them of these vital social learning experiences. As adolescents or emerging adults, this resultant lack of mastery in key social skills may manifest in online environments, leading to negative experiences in these contexts as well (Khalis & Mikami, 2018; Mikami et al., 2015).

To my knowledge, no studies have yet investigated the directional pathway from quality of IG/FB use to ADHD symptoms. Notwithstanding, recent work has pointed to bidirectional
links between ADHD symptoms and the quality of in-person social experiences in adolescents and adults (Baumeister et al., 2005; Ji et al., 2019). Thus, it may be possible that comparably poor quality and negatively valanced social experiences in the online context might have a similarly related to emerging adults’ ADHD symptoms.

**IG/FB Use as Mediating the Associations between ADHD and Internalizing Psychopathology**

Given the role that in-person social functioning may play in mediating the directional associations between ADHD and internalizing psychopathology, I wonder whether this process might manifest similarly in online contexts. Research suggests that a lower quantity of in-person peer relationships might be implicated in the directional association between ADHD to internalizing psychopathology (Bagwell et al., 1998). However, available work suggests that ADHD symptoms predict a higher (not lower) quantity of IG/FB use. As discussed above, this may reflect unique characteristics of the IG/FB context that reduce the barriers to engagement. Therefore, it is unknown whether quantity of social media use will mediate associations between ADHD symptoms and subsequent internalizing psychopathology.

However, ADHD symptoms have been found to predict poorer quality in social media experiences and relationships, which aligns with work in in-person contexts. Further, poor quality in-person relationships as a function of ADHD symptoms have been found to predict subsequent internalizing psychopathology (Humphreys et al., 2013). This suggests that poorer quality of social media experiences may potentially mediate the pathway between ADHD symptoms and internalizing psychopathology and that this mediational model may be consistent across in-person and online contexts.

Regarding mediators of the directional pathway from internalizing psychopathology to
subsequent ADHD symptoms, there is some evidence that a lower quantity of in-person relationships may mediate this pathway (Tseng et al., 2014; Werner-Seidler et al., 2017).

Interestingly, internalizing psychopathology (like ADHD) is linked to a lower quantity of peer relationships and interactions within in-person contexts, whereas available literature suggests the opposite in online contexts. As was the case for the pathway from ADHD symptoms to internalizing psychopathology, it is unknown whether a higher quantity of IG/FB use will mediate associations between internalizing symptoms and subsequent ADHD symptoms.

However, internalizing psychopathology is linked to poorer quality social functioning in both online and in-person contexts. Some circumstantial evidence suggests lower quality in-person peer relationships and interactions as a result of internalizing psychopathology may exacerbate symptoms of ADHD such as inattentiveness and impulsivity (Baumeister et al., 2005; Gotlib & Lee, 1989; Tseng et al., 2014). Therefore, we might expect this process to also occur in the online domain.

Due to the dearth of literature on the topic in general, we do not yet know what role, if any, IG/FB behaviours such as social comparison or passive use might play in mediating associations between ADHD and subsequent internalizing symptoms or vice versa. I do not see either theoretical or empirical evidence that these particular IG/FB behaviours are relevant for ADHD (either in terms of being predicted by or predicting ADHD symptoms).

**Current Study**

I investigated the bidirectional associations between emerging adults’ psychopathology and their IG/FB use. Specifically, I explored how aspects of psychopathology (ADHD and internalizing symptoms) might be bidirectionally related to the quantity of participants’ IG/FB use, their engagement in IG/FB behaviours, and the quality of their online experiences. Further, I
examined whether quantity and quality of IG/FB use mediated the associations between ADHD symptoms and subsequent internalizing psychopathology and vice versa.

The present study improves upon previous investigations in several important ways. First, most existing work on this topic has either been cross-sectional or focused on how IG/FB use might predict psychopathology. Thus, we have a limited understanding of how psychopathology might also predict the way we engage with IG/FB. In a sample of emerging adults with elevations in psychopathology and who perceived at least some negative impact of IG/FB use on their lives, the present study explored not only the role of IG/FB use as a predictor of subsequent psychopathology but also vice versa. To this end, participants were assessed every 2 weeks, for a total of 6 weeks. This mini-longitudinal design allowed us to ascertain better the bidirectional relationships between aspects of psychopathology and IG/FB use.

Second, available research has predominantly focused on the associations between IG/FB use and internalizing psychopathology. Far fewer investigations have examined potential associations between IG/FB use and ADHD symptoms, despite ADHD being common among emerging adults and all available evidence suggesting that ADHD is likely related to IG/FB use. The current study adds to our understanding of how internalizing psychopathology and ADHD are differentially related to social functioning by examining these processes in the online social context. In addition, this was one of the first efforts to investigate the role that online social experiences may play in mediating the relationship between ADHD symptoms and internalizing psychopathology.

Third, existing studies investigating the associations between psychopathology and IG/FB use have largely relied on self-report measures of IG/FB use. The current study incorporated observational measures of IG/FB use to reduce concerns that my findings were
influenced by shared method variance and self-report biases. This included the observational
coding of participants’ IG/FB pages and the recording of participants’ quantity of IG/FB use
directly from their mobile phone apps.

**Study Aims and Hypotheses**

*Aim 1*

My first aim was to investigate the reciprocal associations between internalizing
psychopathology and aspects of IG/FB use, namely quantity of use, IG/FB behaviours, and the
quality of use.

**Hypothesis 1a.** I hypothesized a bidirectional relationship between internalizing
psychopathology and the quantity of IG/FB use, such that greater internalizing psychopathology
would prospectively predict a higher quantity of social use, and higher quantity of IG/FB use
would also predict greater internalizing psychopathology. Existing research has documented both
directional pathways independently (i.e. internalizing psychopathology → quantity of IG/FB use;
quantity of IG/FB use → internalizing psychopathology; Hunt et al., 2018; Yoo & Jeong, 2017).
However, to my knowledge, no studies have investigated both pathways within the same sample.

**Hypothesis 1b.** I hypothesized a bidirectional relationship between internalizing
psychopathology and engagement in specific IG/FB behaviours, such that greater internalizing
psychopathology would prospectively predict more engagement in maladaptive IG/FB
behaviours (passive use and social comparison) and that more engagement in maladaptive IG/FB
behaviours would also predict greater internalizing psychopathology. Existing research has
documented both directional pathways independently (i.e. internalizing psychopathology →
IG/FB behaviours; IG/FB behaviours → internalizing psychopathology; Frison & Eggermont,
2015; Nesi et al., 2017). Again, no work has sought to formally examine the bidirectional
relationships between IG/FB behaviours and internalizing psychopathology.

**Hypothesis 1c.** I hypothesized a bidirectional relationship between internalizing psychopathology and the quality of IG/FB use, such that higher internalizing psychopathology would prospectively predict poorer quality IG/FB use (less positive and more negative IG/FB interactions and relationships), and poorer quality IG/FB use would also predict greater internalizing psychopathology. Available work has investigated each pathway independently (i.e. internalizing psychopathology → quality of IG/FB use; quality of IG/FB use → internalizing psychopathology; Mikami et al., 2019; Szwedo et al., 2011), but again, no studies have evaluated both directional pathways within the same sample.

**Aim 2**

My second aim was to investigate the reciprocal associations between ADHD symptoms and aspects of IG/FB use, namely quantity of use and the quality of use. I did not explore associations with the IG/FB behaviours of social comparison and passive use, as there was a lack of evidence that they are connected to ADHD symptoms.

**Hypothesis 2a.** I hypothesized a bidirectional relationship between ADHD symptoms and the quantity of IG/FB use, such that greater ADHD symptoms would be longitudinally associated with higher quantity of IG/FB use, and higher quantity of IG/FB use would predict increased subsequent ADHD symptoms. Preliminary research has provided some support for positive cross-sectional associations between ADHD symptoms and quantity of IG/FB use (Khalis & Mikami, 2018; Ra et al., 2018), but the current work is important to differentiate between ADHD symptoms → quantity of IG/FB use versus quantity of IG/FB use → ADHD symptoms.

**Hypothesis 2b.** I hypothesized a bidirectional relationship between ADHD symptoms
and the quality of IG/FB use, such that greater ADHD symptoms would predict poorer quality IG/FB use (less positive and more negative IG/FB interactions and relationships), and poorer quality IG/FB use would predict greater ADHD symptoms. Available evidence provides support for the directional pathway from ADHD symptoms to poorer quality of IG/FB use (Mikami et al., 2015). Although, to my knowledge, no studies have tested whether quality of IG/FB use predicts subsequent ADHD symptoms, analogous work suggests that poor quality social experiences in-person might also predict increases in ADHD symptoms (Baumeister et al., 2005; Tseng et al., 2014). Therefore, I examined both pathways in the current study.

**Aim 3**

My third aim was to explore the quantity and quality of IG/FB use as mediators of the associations between ADHD symptoms and internalizing psychopathology. I do not explore IG/FB behaviours of social comparison and passive use as mediators due to a lack of evidence that they are connected to ADHD symptoms.

**Hypothesis 3a.** In an exploratory manner, I investigated whether the quantity of IG/FB use mediated associations between ADHD symptoms and subsequent internalizing symptoms. Literature suggests that a lower quantity of in-person peer relationships might be implicated in the directional pathway between ADHD symptoms and internalizing symptoms. Nonetheless, studies point to higher (not lower) quantity of IG/FB use as associated with ADHD symptoms (Khalis & Mikami, 2018; Seabrook et al., 2018). Thus, although there is enough rationale to test this mediational pathway, it is unclear how findings for quantity of IG/FB use would compare to what is found in-person. As such, I investigated the potential mediator of quantity of IG/FB use in an exploratory manner.

**Hypothesis 3b.** I hypothesized that greater ADHD symptoms would longitudinally
predict greater internalizing psychopathology and that this association would be mediated by poorer quality IG/FB use. There is partial evidence for this association, given that ADHD symptoms have been found to predict poorer-quality IG/FB interactions (Mikami et al., 2015), and that these poor-quality experiences on these platforms have also been linked to an exacerbation of internalizing psychopathology in other work (Frison et al., 2016). In in-person social contexts, individuals with ADHD have also been found to experience poorer quality relationships, which in turn led to increases in depressive symptoms (Biederman et al., 2008; Eadeh et al., 2017; Herman et al., 2007). I tested this mediational pathway in the online context.

**Hypothesis 3c.** In an exploratory manner, I investigated whether the quantity of IG/FB use might mediate associations between internalizing psychopathology and subsequent ADHD symptoms. Work in in-person contexts suggests that a lower quantity of in-person peer relationships might be implicated in the directional association between internalizing psychopathology to ADHD symptoms (Tseng et al., 2014; Werner-Seidler et al., 2017). However, research suggests higher (not lower) quantity of IG/FB use associated with internalizing psychopathology (Ra et al., 2018; Yoo & Jeong, 2017). Thus, as with Hypothesis 3a, this mediational model was exploratory.

**Hypothesis 3d.** I hypothesized that greater internalizing psychopathology would longitudinally predict greater ADHD symptoms and that this association would be mediated by poorer quality IG/FB use. There is some indirect evidence for this association, given that internalizing symptoms have been found to predict poorer-quality IG/FB interactions (Feinstein et al., 2012) and that poor quality social experiences in in-person contexts have been linked to an exacerbation of ADHD symptoms (Ji et al., 2019). I tested this mediational pathway in the current study.
Method

Participants

Participants were 399 emerging adult users of FB or IG. Their mean age was 20.89 years old (SD = 2.72), and the range was 17 to 29 years old. They were recruited from two sources: the Human Subjects Pool (HSP) at the University of British Columbia (n = 270) and the community via online advertisements (n = 129). HSP participants were compensated with course credit, while community participants were provided monetary compensation. With regards to cultural background, participants reported being East Asian (29%), European/White (19%), Southeast Asian (13%), South Asian (13%), Middle Eastern (3%), Hispanic (2%), African (1%), First Nations (.5%), and other (7%). The current dissertation is part of a larger study aimed at changing the behaviours of IG/FB users who are elevated on internalizing and/or ADHD symptoms, with the goal of increasing users’ well-being.

Participants first completed a pre-screening questionnaire administered separately through the HSP web portal (for HSP participants) and by the current study team (for community participants). To be eligible for the study, on the pre-screening, participants needed to endorse using either FB or IG at least once per day. They also completed an item assessing the perceived impact that social media use has had on their life, which was on a 6-point scale (1 = Mostly positive to 5 = Mostly negative; or 6 = No impact) and participants needed to have a score between 3 (Mix of positive and negative) and 5 to be included in the study. The first criterion was to ensure participants were IG/FB users, and the second was to prevent ceiling effects in the larger study on users’ well-being.

Participants also needed to have reported elevations on either internalizing symptoms and/or ADHD symptoms in order to recruit a sample at risk for psychopathology. To this end,
the pre-screening questionnaire included two items assessing internalizing psychopathology (i.e., “I’ve been feeling depressed, down, sad, empty, or hopeless” and “I’ve been continually worried or anxious about a number of events or activities in my daily life”) on a 4-point scale (0 = Never or Rarely to 3 = Very Often), with participants needing to have a combined score of at least 4 out of a maximum of 6 to be eligible for the study. Two pre-screening items assessing ADHD symptoms (i.e., “I say or do things without thinking them through first” and “I have difficulty organizing things or staying organized about things”) on a 5-point scale (0 = Not at all to 4 = Extremely) were also embedded, with participants needing to have a combined score of at least 4 out of a maximum of 8 to be eligible for the study.

Taken together, study participants represent a non-clinical sample of emerging adults with elevations in psychopathology symptoms and who perceived their social media use to have had at least some negative impact on their lives. See Appendix G for the flowchart depicting the number of participants who engaged in prescreening and who met versus did not meet each inclusion criteria.

Procedure

Data were collected between September 2019 through October 2021. After the inclusion criteria were met, participants’ consent was obtained. Owing to the design of the larger investigation in which this dissertation took place, participants were randomly assigned to one of three experimental conditions, for a period of 6 weeks: (a) Tutorial, where they were asked to take a tutorial aimed at providing participants with tools and strategies that would allow them to engage in more effective IG/FB use; (b) Fasting, where participants were asked to abstain from (if possible) or cut back on their IG/FB use; (c) Control, where they were not told to do anything different in their IG/FB use. Each condition consisted of three online modules that participants
completed every 2 weeks, with videos, infographics, and interactive activities to facilitate participant engagement with the content. In the current study, I was interested in the bidirectional associations between psychopathology and IG/FB use, as opposed to the efficacy of the experimental manipulation. I used multi-group analyses to determine whether participants could be collapsed across the three conditions (so as not to lose data). Crucially, I did not expect any bidirectional pathways between IG/FB use and psychopathology to differ across conditions, even if the Tutorial or Fasting conditions lead to overall group mean differences in IG/FB use or psychopathology. In all three conditions, participants completed the same study measures on the same schedule at four different timepoints over the 6 weeks (T1, T2, T3, and T4), with each timepoint 2 weeks apart.

The first session (T1) occurred either in-person in the laboratory or via Zoom (a secure video-conferencing software). Whether in person or over Zoom, the participant was met by a trained research assistant (RA). After the consent process, participants completed self-reported questionnaires online through Qualtrics to report on psychopathology, IG/FB behaviours, and quantity of IG/FB use. Participants were asked to take a screenshot of the Screentime tracker on their phone that indicates the amount of time they have spent on IG and/or FB in the current week. For the observational measures, we asked participants for their permission to friend or follow them on whatever platform they regularly used, using an account associated with the study. If they used both FB and IG regularly (defined as at least once per day), we asked for their consent to have us friend or follow them on both platforms. Every 2 weeks, an RA used the study account to view participants’ FB and IG pages and captured screenshots of the posts occurring in the most recent 2 weeks. An observational coding system was applied to these screenshots to generate metrics of participants’ quality of IG/FB use (see Measures). After completing their
questionnaires, participants were presented with content from the first module of the experimental condition to which they were assigned.

All self-report and observational measures, except for the measure of ADHD symptoms, were completed at each of the four timepoints across 6 weeks. The ADHD symptom measure was completed twice, at T1 and T4 (because of the low likelihood that this measure will show changes over only 2 weeks; see ADHD in the Measures section). Specifically, at T2, occurring 2 weeks after T1, participants were sent the self-report questionnaires to complete at home using a personal computer or mobile device. They were also instructed to take another screenshot of their Screentime tracker. After completing the self-report questionnaires and sending the screenshots to study personnel, participants completed the second online module of their assigned experimental condition. RAs coded the participants’ FB or IG content on their pages occurring in the past 2 weeks.

This entire procedure was repeated at T3, 2 weeks later, consisting of participant self-report measures, screenshots, and observational coding of participants’ FB and IG pages. At this time, participants completed the third online module of their assigned condition.

At a final assessment point 2 weeks later at T4, participants completed self-report questionnaires and sent screenshots, and RAs coded their FB and IG pages. Participants did not complete an online module at this timepoint. Participants were then debriefed and offered access to the online modules from all three experimental conditions.

**Measures**

**Participant Demographics**

As part of the pre-screening questionnaire, participants were asked to report their age, gender, cultural background, and country of origin.
**Quantity of IG/FB Use**

**Self-Reported Daily IG/FB Use.** Participants were asked to report on the estimated amount of time they spent a day on IG or FB over the last 2 weeks. Similar questions have previously been used to assess the quantity of IG/FB use (Barry et al., 2017; S. M. Coyne et al., 2018).

**Self-Reported IG/FB Intensity.** The Multidimensional Facebook Intensity Scale (MFIS; Orosz et al., 2016) is a 13-item self-report scale designed to assess the extent of FB users’ engagement on the platform and the intensity of their use. A modified version of this scale was used to measure the intensity of use on both FB and IG. Participants were asked to indicate their level of agreement with statements about their IG/FB use over the last 2 weeks (e.g., “I spent more time on Facebook or Instagram than I would like to”) on a 5-point scale (1 = *Strongly disagree* to 5 = *Strongly agree*). The MFIS has been validated in three separate samples, demonstrating acceptable internal consistency and test-retest reliability. The measure also demonstrated good convergent and criterion validity (Orosz et al., 2016). A mean score of all item responses was calculated, with higher values indicating more intense IG and FB use (α = .80 to .92).

**Observed Weekly IG/FB Use.** Participants were asked to send study personnel a screenshot of their Screentime page, an application on their mobile device that provides a report on how many minutes the participant has spent on FB or IG in the last 7 days (see Appendix B). A recent survey revealed that the majority of social media users access these platforms through their mobile devices (Herhold, 2018), which suggests that participants’ data from the Screentime tracker are likely to reflect their typical use. However, participants were also asked to try to use their mobile device to access IG/FB instead of their laptop or desktop computers. A total score
was calculated by summing the number of minutes participants spent on both FB and IG.

**IG/FB Behaviours**

**Passive IG/FB Use.** The Passive Active Use Measure (PAUM; (Gerson et al., 2017) is a 13-item self-report scale designed to measure FB users’ active and passive usage behaviours. This measure was validated in an adult Mturk sample and demonstrated adequate internal consistency and acceptable test-retest reliability (Gerson et al., 2017). A modified version of this scale comprised of 15 items was used to measure behaviours on both FB and IG (e.g., “Posting pictures, videos, or status updates on your own page”). Participants self-reported on how frequently they engaged in activities on IG/FB on a scale of 1 (*Never - zero percent of the time*) to 5 (*Very frequently – close to 100% of the time*). In order to extract the items that captured passive IG/FB use, a Confirmatory Factor Analysis (CFA) was conducted. Results suggested a four-factor solution which aligned with theoretical considerations, with four items loading onto the passive IG/FB use factor (see Appendix A). A composite score for passive IG/FB use was computed by calculating the mean of the scores of the four items that loaded on this factor.

**Social Comparison.** The Iowa-Netherlands Comparison Orientation Measure-Modified (INCOM-Modified; Gibbons & Buunk, 1999) is a self-report scale assessing the degree to which individuals engage in social comparison (regardless of the direction of those comparisons). This measure has previously been adapted for assessing social comparison on FB (Cramer et al., 2016; Steers et al., 2014). A modified version of this scale was used to fit both FB and IG. Participants responded to 11 items by indicating their level of agreement with statements regarding the degree to which they are making social comparisons on IG and FB in the last 2 weeks (“I often compared how I am doing socially [e.g., social skills, popularity] with other people”), with each item answered on a Likert-type metric (1 = *Strongly disagree*; 5 = *Strongly agree*).
agree). A total score was calculated by reverse-scoring negatively keyed items and calculating the mean score across all items (α = .80 to .88). Higher values indicated a greater tendency to engage in social comparison. The original scale has demonstrated good discriminant validity (Gibbons & Buunk, 1999). Both the original scale and modified FB version have demonstrated good internal consistency (Cramer et al., 2016; Steers et al., 2014).

The Social Comparison Rating Scale (SCRS; Allan & Gilbert, 1995) is a self-report scale originally designed to assess the direction of social comparisons people make (i.e., positive or negative), without an indication of the amount of social comparisons they are making. This scale has been adapted to measure the direction of social comparisons on IG (Lup et al., 2015) and FB (Feinstein et al., 2013). Participants responded to 11 items by selecting a number between 1 to 10 that described their perceived position between two poles when comparing themselves to others on FB or IG (e.g., inferior/superior, unlikeable/more likeable). A total score was calculated by summing all item responses, with higher values indicating a tendency to have a more positive view of oneself (α = .92 to .95). This measure has demonstrated good internal consistency and was found to be associated with psychopathology (Allan & Gilbert, 1995; Feinstein et al., 2013; Lup et al., 2015).

**Quality of IG/FB Use**

Trained RAs observationally coded participants’ FB and IG activity on participants’ timelines using a FB Coding Manual (Mikami et al., 2015) modified to code IG activity as well. Content posted by the participants and content received from friends or followers on participants’ timelines were coded independently. Similarly, posts and comments were coded independently. Therefore, for each quality code, there were four values reflecting the amount of this code in: participant posts, friend posts, participant comments, friend comments.
Coders were kept unaware of all other data about the participant. RAs double-coded all participants’ FB and IG activity to assess interrater reliability in the coding system. Final scores on the quality of IG/FB use variables were an average of the two coders’ scores. To assess the reliability between the two coders, I calculated interclass correlation coefficients (ICC) for continuous variables (connection, emotional support, verbal aggression, and deviant content) and kappa for categorical variables (positive and negative emotion). ICC conventions are: below .50 = poor; .50-.75 = moderate; .75-.90 = good; and above .90 = excellent reliability (Koo & Li, 2016). Guidelines for kappa (κ) characterize values below .40 as poor, .40-.75 as fair to good, and above .75 as excellent (Fleiss, 1973).

**Connection.** Coders recorded the number of posts and comments on the participant’s timeline (from the participant or friend) that suggested that the participant and their friend know each other beyond a superficial level (ICC = .82 to .91). For example, a photo where a IG/FB friend is tagged by the participant or comments between participants and IG/FB friends that reference plans to spend time together, display connection. This construct is meant to differentiate between online interactions with true friends versus interactions with strangers or acquaintances. The number of posts from friends suggesting connection has been found to be associated with greater observed positivity in in-person peer interactions (Mikami et al., 2010). Proportion scores were calculated by dividing the number of posts (and comments) suggesting connection by the total number of posts (and comments) made during the coding period.

**Emotional Support.** Coders recorded the number of posts and comments on the participant’s timeline (from the participant or friend) that suggest the participant is conveying encouragement, compliments, validation, or love to a recipient or, conversely that the friend is conveying these sentiments to the participant (ICC = .76 to .98). For example, comments in
which a friend said “you are amazing” would suggest emotional support. Proportion scores were calculated by dividing the number of posts (and comments) suggesting emotional support by the total number of posts (and comments) made during the coding period.

**Verbal Aggression.** Coders recorded the number of posts and comments on the participant’s timeline (from the participant or friend) that put down, insult, or criticize the recipient (ICC = .95 to 1). For example, a post directed from the participant to an IG follower (on the participant’s page) that said, “You’re sooooo ugly!”, would contain verbal aggression. Proportion scores were calculated by dividing the number of posts (and comments) suggesting verbal aggression by the total number of posts (and comments) made during the coding period.

**Deviant Content.** Coders recorded the number of posts and comments on the participant’s timeline (from the participant or friend) that uses profanity not acceptable on network TV, has any sexual content, nudity, illegal behaviours, or excessive use of legal substances (ICC = .75 to .92). This code is intended to capture activities or content that employers may consider inappropriate. Proportion scores were calculated by dividing the number of posts (and comments) suggesting deviant content by the total number of posts (and comments) made during the coding period.

**Positive Emotion.** An overall impression of positive emotion was derived from content posted by participants and friends on the participant’s timeline (κ = .77). For each post, photo, or video, coders rated the extent to which positive emotion was displayed on a 3-point scale from 1 (Low) to 3 (High). A composite score of positive emotion was calculated by averaging the scores of all posts made during the coding period.

**Negative Emotion.** An overall impression of negative emotion was derived from content posted by participants and friends on the participant’s timeline (κ = .90). For each post, photo, or
video, coders rated the extent to which negative emotion was displayed on a 3-point scale from 1 (Low) to 3 (High). A composite score of negative emotion was calculated by averaging the scores of all posts made during the coding period.

**Internalizing Psychopathology**

The Depression Anxiety Stress Scale-21 (DASS-21; S. H. Lovibond & Lovibond, 1995) is a 21-item self-report measure (a short form of the original 42-item DASS) designed to assess physical and emotional symptoms of depression, anxiety, and stress. Participants were asked to rate how much a statement applied to them over the past 2 weeks (e.g., “I felt that life was meaningless”) on a 4-point scale (0 = Did not apply to me at all to 3 = Applied to me very much or most of the time). This measure has demonstrated good internal consistency and convergent validity (Antony et al., 1998; P. F. Lovibond & Lovibond, 1995). The DASS has been found to be sensitive to changes in internalizing symptoms over 2 weeks in both clinical and community samples (Brailovskaia et al., 2020; Hooke & Page, 2002). As recommended by the authors of the measure (S. H. Lovibond & Lovibond, 1995), a total score was calculated by first summing the scores of all items and multiplying the summed score by 2 (as the DASS-21 is a short form version of the original DASS-42), with higher scores indicating greater symptomatology (α = .91 to .94).

**ADHD Symptoms**

The Barkley Current Symptoms Scale (Murphy & Barkley, 1996) is a self-report scale designed for assessing current ADHD symptoms in adults based on DSM-IV criteria. Participants responded to nine items measuring inattention (e.g., “I don’t pay close attention to details, so I will make careless mistakes in my work”) and an additional nine items measuring hyperactivity/impulsivity (e.g., “I feel restless and want to get up and move about when I am..."
supposed to sit still or wait for things”), with each item answered on a 4-point scale (0 = *Never or rarely* to 3 = *Very often*). A total score was calculated that reflects the mean of all items (α = .87 to .92). The scale is widely used, shows strong convergent validity with other ADHD rating scales (Gomez, 2011), and has been validated in a university sample (Ladner et al., 2011).

No work has yet assessed the sensitivity of the Current Symptoms Scale to detect short-term changes in ADHD symptoms, but evidence from similar measures that assess the severity of the 18 DSM-IV criterion symptoms of ADHD suggests that this type of self-report measure is sensitive to changes in symptoms over 8 weeks (Zylowska et al., 2008). Unlike the DASS, however, there is no evidence to date that the Current Symptoms Scale is sensitive to changes over 2 weeks. Thus, the Current Symptoms Scale was collected at T1 and T4 only (representing a 6-week interval), and I examined the extent to which study participants’ ADHD symptoms fluctuated over this period.

**Data Analytic Plan**

**Power Analysis**

Prior to data collection, I conducted a power analysis using pwrSEM software (Wang & Rhemtulla, 2020). This software allows for determination of the required sample size to detect both misspecifications of a model as well as target effects or parameters. Results from MacCallum and colleagues’ (1996) root mean square error of approximation (RMSEA) test of close and not-close fit suggests that a sample size of \( n = 420 \) yields power of approximately 80% to reject a misspecified model with an amount of misspecification corresponding to RMSEA = .05 at \( \alpha = 0.05 \). Results of a Wang and Rhemtulla (2020) power analysis for parameter estimation showed that at a sample size \( n = 420 \), the power to detect small cross-lagged coefficients (\( \beta = 0.20 \)) for pathways between psychopathology and IG/FB use ranged from .81 to .87. I recognize
that the sample size I ultimately attained for the study was \( n = 399 \). The COVID-19 pandemic, the length and intensity of the study, and the inclusion criteria may have contributed to a lower-than-expected sample size, which negatively affected the statistical power of the analyses.

**General Longitudinal Data Analysis Plan**

Hypotheses 1a, 1b, and 1c were tested using a four-wave multiple-indicator Random Intercept Cross-Lagged Panel Model (RI-CLPM) in the Structural Equation Modeling (SEM) framework to assess the bidirectional associations between IG/FB use and internalizing psychopathology across the four study timepoints. Historically, cross-lagged panel models (CLPM) have been employed to study reciprocal associations between two variables of interest over time. Recent critiques have argued that CLPM does not account for stable, trait-like differences between individuals, and resultant parameter estimates may not properly represent within-person changes or relationships (Hamaker et al., 2015). The RI-CLPM, an extension of CLPM, decomposes variables of interest into a time-invariant between-person component and a time-variant within-person component (Hamaker et al., 2015). The autoregressive, cross-lagged, and covariance paths between the within-person components of the variables are simultaneously estimated (see Figure 1). Thus, in a RI-CLPM, cross-lagged paths reflect the longitudinal relationships between variables at the within-person, state-like level. A requirement of the RI-CLPM is that data be collected in at least three waves.

As ADHD symptoms were only measured at T1 and T4, a RI-CLPM approach was unsuitable for testing hypotheses 2a and 2b. These hypotheses were tested using CLPM to assess the bidirectional associations between ADHD symptoms and IG/FB use across two timepoints. A limitation is that I am unable to determine the extent to which the findings from these analyses are accounted for by within-person processes or between-person differences.
Hypotheses 3a, 3b, 3c, and 3d were tested using a series of path analyses in the SEM framework to assess quantity and quality of IG/FB use as mediators of the longitudinal associations between ADHD symptoms and internalizing psychopathology.

Analyses were performed using Mplus 8.0 (Muthén & Muthén, 2017). Following recommendations by Kline (2011), standardized root mean square residual (SRMR), chi-square ($\chi^2$), RMSEA, and comparative fit index (CFI) were used to assess model fit. A model is suggested to be of good fit when the chi-squared-to-degrees-of-freedom ratio ($\chi^2/df$) is below 3, $\chi^2 (p > .05)$, RMSEA is below .05, SRMR is below .08, and the CFI is equal to or larger than .95 (Hu & Bentler, 1999; Kline, 2011). Differences in model fit between nested models were assessed using Satorra-Bentler scaled Chi-square difference tests. Recent work has recommended the following guidelines for interpreting the size of cross-lagged effects of CLPM and RI-CLPM models: .03 = small effect; .07 = medium effect; and .12 = large effect (Orth et al., 2022). To control for increases in the false discovery rate (i.e., occurrence of Type 1 errors) that can result from conducting multiple analyses (Cribbie, 2017), I applied the Benjamini & Hochberg (1995) correction procedure to my results.
Hypotheses 1a, 1b, and 1c

I constructed three multiple-indicator RI-CLPMs to assess the bidirectional associations between internalizing psychopathology and the three dimensions of IG/FB use (quantity of IG/FB use, IG/FB behaviours, and quality of IG/FB use). I first specified each measurement model by attempting to create latent variables reflecting a dimension of IG/FB use. When CFAs did not support the specified measurement model, modifications were made, guided by the modification indices and theoretical considerations. These modifications included dropping the manifest variable(s) that did not load sufficiently together with the others when forming the latent construct or running separate models for each manifest variable.
Once a sufficiently well-fitting measurement model was specified, I tested the measurement invariance of the factor loadings on the latent IG/FB variable across all timepoints. This is a requirement of longitudinal multiple-indicator RI-CLPM and CLPM (Hamaker et al., 2015) to ensure that the latent constructs are not being indicated differently over time (i.e., that the loadings of indicator variables are equal across measurement waves). Measurement invariance is necessary to make meaningful comparisons between the constructs measured at different timepoints. To do this, a hypothesized model that constrained all factor loadings to be equal across all timepoints was compared with a free model where factor loadings were allowed to vary across timepoints. The fit statistics of these two models were compared to determine whether the constraints imposed on the hypothesized model significantly worsened model fit. If the Chi-square difference test indicated that the fit between the two models was not significantly different, measurement invariance was established, and the constrained model was retained. In situations where measurement invariance was not established, I ran separate RI-CLPMs for each manifest variable that were initially thought to indicate the latent IG/FB use factor (see Figure 2).

I also tested the measurement invariance of the factor loadings across experimental conditions. Similar to the procedure above, a hypothesized model that constrained all factor loadings to be equal across conditions was compared with a free model in which factor loadings were allowed to vary across conditions. If the Chi-square difference test indicated that the fit between the two models was not significantly different, measurement invariance was established, and the constrained model was retained.

Once measurement invariance was established, the structural model of the RI-CLPM was specified. An overarching random intercept factor capturing the time-invariant component of the latent variable of IG/FB use was specified by creating a latent factor (RIFSM) indicated by
IG/FB use at each of the four timepoints, with all factor loadings set to 1. The random intercept factor for internalizing psychopathology (RIInt) was specified by creating a latent factor indicated by internalizing psychopathology at each of the four timepoints, with all factor loadings set to 1. These random intercept factors represented the stable differences of these variables between individuals.

For the within-person part of the model, the IG/FB use factors created in the measurement models and the manifest internalizing psychopathology variable were regressed on their own latent factor with each loading constrained to 1 at each timepoint, for a total of eight within-person latent factors (i.e., one for IG/FB use and one for internalizing psychopathology, at each of the four timepoints). The residual variances of the latent IG/FB use variables specified in the measurement models and the internalizing psychopathology model were set to 0, to ensure that all variations in the indicator variables (for both IG/FB use and internalizing psychopathology) were fully captured by the within-person and between-person factor structure. The correlations between random intercept latent factors were estimated and reflect how the between-person differences in IG/FB use and internalizing psychopathology are associated. The latent factors (for both IG/FB use and internalizing psychopathology) in the within-person part of the RI-CLPM were used to examine the autoregressive, cross-lagged, and correlation paths between the two variables. The autoregressive stability paths indicate the extent to which an individual’s deviation from their own expected score at a previous timepoint predicts future within-person deviations in the same variable at a future timepoint. Cross-lagged paths refer to the extent to which within-person deviations in one variable at a previous timepoint predict within-person changes in another variable at a future timepoint and allow us to assess bidirectional associations. As the lag between timepoints were approximately the same across all
four timepoints, I restricted the autoregressive and cross-lagged paths to be equal over time to reduce model complexity (Hamaker et al., 2015).

**Figure 2**

**RI-CLPM with Manifest Variables Only**

Notes. SM = IG/FB use; WFSM = Within-component of IG/FB use; RIFSM = Between-component of IG/FB use; Int = Internalizing psychopathology; WInt = Within-component of internalizing psychopathology; RIInt = Between-component of internalizing psychopathology.

**Hypotheses 2a and 2b**

I constructed two multiple-indicator CLPM models to assess the bidirectional associations between ADHD symptoms and two dimensions of IG/FB use (quantity of IG/FB use and quality of IG/FB use; see Figure 3). The process of specifying the measurement model for both latent factors of IG/FB use was the same as in the RI-CLPM section above: The only difference was that measurement invariance was tested across two timepoint waves rather than four. In situations where measurement invariance was not established, I ran separate CLPMs for each observed variable that were initially thought to indicate the hypothesized latent IG/FB use factor (see Figure 4).
Once measurement invariance was established, the structural model of the CLPM was specified. In each model, the latent variable of IG/FB use and ADHD symptoms was entered at T1 and T4. Two autoregressive paths, two cross-lagged paths, and two covariance paths were estimated simultaneously in the model. Covariance paths represent the nondirectional relationships among independent variables at the same timepoint. The autoregressive paths assess the stability of each variable from one timepoint to a subsequent timepoint. Cross-lagged paths refer to the extent to which a variable at a previous timepoint predicts another variable at a future timepoint. However, unlike the RI-CLPM, I am unable to disaggregate the contributions of between-person and within-person processes to these parameter estimates.

**Figure 3**

*CLPM with Multiple Indicators*

Notes. SM = IG/FB use indicator; FSM = Latent IG/FB use factor; ADHD = ADHD symptomatology.
Hypotheses 3a, 3b, 3c, and 3d

I constructed four SEM models to assess two dimensions of IG/FB use (quantity and quality of IG/FB use) as mediators of the association between ADHD symptoms at T1 with internalizing psychopathology at T4 (Hypotheses 3a and 3b; Figure 5) and vice-versa (Hypotheses 3c and 3d, Figure 6). The process of specifying the measurement model for both latent factors of IG/FB use was the same as outlined in the RI-CLPM section above, with one exception. In mediator models, I computed the means of the T2 and T3 scores of indicator variables, and these means were used as indicators of the latent IG/FB use variables (T2+T3). As measurement error is present at every timepoint, I believed that averaging across timepoints might serve to reduce the overall error present in mediation analyses. There were relatively high correlations between the indicator variables of quantity of IG/FB use at T2 and T3 ($r = .54 - .78$). Correlations between the indicator variables of quality of IG/FB use were relatively lower ($r = .16 - .36$), which is not surprising given that these variables were observationally coded as
opposed to self-reported. Internalizing psychopathology and ADHD symptoms at T1 were also included as covariates for Hypothesis 3a and 3b, and Hypothesis 3c and 3d, respectively.

**Figure 5**

*Mediation of ADHD Symptomatology on Internalizing Psychopathology*

*Notes.* SM = IG/FB use indicator; FSM = Latent IG/FB use factor; ADHD = ADHD symptomatology; Int = Internalizing psychopathology.
Potential Covariates/Moderators

I considered the inclusion of a number of potential covariates in the RI-CLPM and the CLPM models. These covariates were selected for theoretical reasons, and my decisions about whether and how to include them were informed by preliminary data analyses.

Source of Recruitment

Using a series of t-tests, group differences in all IG/FB and psychopathology variables between HSP participants and community participants were examined. Because no group differences were detected, source of recruitment was not included as a covariate in any RI-CLPM and CLPM analyses.

Gender

There may be gender differences in emerging adults’ IG/FB use and psychopathology (Perrin & Anderson, 2019; Rousseau et al., 2017). A series of one-way analysis of variance
(ANOVA) tests were used to assess any group differences between genders in all IG/FB use and psychopathology variables. Table 1 summarizes these results. Demographic information (including gender) was missing for approximately 9% of the sample \((n = 37)\), the majority of whom were recruited from HSP. To access the demographic information for participants recruited through HSP, participants were asked to provide their HSP ID which would allow us to link to their responses to the pre-screening questionnaire completed through the HSP web portal. For 34 participants, this HSP ID was either not provided or was incorrect, which prevented us from obtaining their demographic information. Approximately 85% of the sample identified as cisgender women \((n = 308)\), and 12% as cisgender men \((n = 42)\). Although participants could self-identify beyond the gender-binary (e.g., two-spirit, transgender man), there were few participants in each group. I elected to collapse these participants into a third category (non-binary; \(n = 12\)) to increase statistical power but acknowledge that this ignores the differences between each of these identities. I also note that the large amount of missing data for variables measuring quality of IG/FB use at each timepoint (see p. 67) resulted in sub-groups with sample sizes too small (e.g., \(n = 5\)) to be included in an ANOVA. Results revealed one main effect, such that participants who identified as cis-women reported more intense IG/FB use at T2 than cis-men participants \((F(2, 330) = 2.24, p = .04)\), but not participants who were non-binary. Given hesitancy about collapsing all non-binary participants into one category, the small \(n\) in the non-binary and cis-man groups overall, and the general lack of differences between groups on study variables, I did not include gender as a covariate in analyses.
### Table 1

*Mean Differences in Study Variables across Gender Groups*

<table>
<thead>
<tr>
<th>Variables</th>
<th>Cis-woman</th>
<th></th>
<th>Cis-man</th>
<th></th>
<th>Non-binary</th>
<th></th>
<th>F</th>
<th>p</th>
</tr>
</thead>
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<td></td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td>Mean</td>
<td>SD</td>
<td></td>
<td></td>
</tr>
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<td>23.48</td>
<td>42.60</td>
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<td>62.00</td>
<td>26.91</td>
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<td>.06</td>
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<td>41.79</td>
<td>29.69</td>
<td>48.50</td>
<td>21.69</td>
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<td>.36</td>
</tr>
<tr>
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<td>25.11</td>
<td>38.38</td>
<td>29.78</td>
<td>45.33</td>
<td>21.29</td>
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<td>.69</td>
</tr>
<tr>
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<td>26.20</td>
<td>33.72</td>
<td>27.33</td>
<td>51.27</td>
<td>25.03</td>
<td>2.05</td>
<td>.13</td>
</tr>
<tr>
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<td>.54</td>
<td>1.15</td>
<td>.53</td>
<td>1.29</td>
<td>.86</td>
<td>.14</td>
<td>.87</td>
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<td>0.91</td>
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<td>291.83</td>
<td>387.64</td>
<td>326.80</td>
<td>507.90</td>
<td>225.47</td>
<td>.70</td>
<td>.50</td>
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<tr>
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<td>331.42</td>
<td>304.50</td>
<td>234.28</td>
<td>522.97</td>
<td>351.12</td>
<td>1.76</td>
<td>.17</td>
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<tr>
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<td>306.07</td>
<td>246.13</td>
<td>238.55</td>
<td>404.09</td>
<td>377.39</td>
<td>1.86</td>
<td>.16</td>
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<td>299.36</td>
<td>282.83</td>
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<td>496.76</td>
<td>.77</td>
<td>.47</td>
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<td>135.45</td>
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<td>89.03</td>
<td>84.51</td>
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<td>.06</td>
<td>.95</td>
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<td>100.36</td>
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<td>79.36</td>
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<td>.47</td>
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<td>.56</td>
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<td>.42</td>
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<td>Variables</td>
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<td>Non-binary</td>
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<td>F</td>
<td>p</td>
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<tr>
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<td>.87</td>
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<td>.76</td>
<td>.20</td>
<td>.82</td>
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<tr>
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<td>2.68</td>
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<td>3.13</td>
<td>.99</td>
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<td>2.84</td>
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<td>2.80</td>
<td>.97</td>
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</table>

*Note.* IG/FB = Instagram and Facebook; MFIS = Multidimensional Facebook Intensity Scale; SCRS = Social Comparison Rating Scale; INCOM = Iowa-Netherlands Comparison Orientation Measure; PT Connection = Participant posts evidencing connection; PT Emo Given = Participant posts evidencing emotional support given.
Country of Origin

Some participants in the HSP system are international students who moved away from their home countries to attend university in Canada. IG/FB use has been found to differ depending on a person’s country of origin and cultural background (Jackson & Wang, 2013). This is particularly relevant for those from countries where social media platforms like FB and IG are actively blocked; this includes China, Iran, Syria, and North Korea. To simplify the analyses, a dummy variable was created: 0 = Country of origin where Instagram and Facebook are not blocked; 1 = Country of origin where Instagram and Facebook are blocked. A series of independent samples t-tests were used to assess any group differences in all outcome variables (psychopathology and IG/FB use). Table 2 presents findings that there were several significant group differences between participants who did versus did not originate from countries where FB and IG are blocked. Consequently, I included country of origin as a covariate in all RI-CLPM and CLPM analyses.
### Table 2

**Mean Differences in Study Variables across Country of Origin**

<table>
<thead>
<tr>
<th>Variables</th>
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<th>IG/FB Blocked (n = 39)</th>
</tr>
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<tbody>
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</tr>
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</tr>
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</tr>
<tr>
<td>Internalizing symptoms T4</td>
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</tr>
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</tr>
<tr>
<td>ADHD T4</td>
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</tr>
<tr>
<td>Observed weekly IG/FB use T2</td>
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<td>328.46</td>
</tr>
<tr>
<td>Observed weekly IG/FB use T3</td>
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<td>306.55</td>
</tr>
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<td>Observed weekly IG/FB use T4</td>
<td>343.95</td>
<td>303.72</td>
</tr>
<tr>
<td>Self-reported daily IG/FB use T1</td>
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<td>109.51</td>
</tr>
<tr>
<td>Self-reported daily IG/FB use T2</td>
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</tr>
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<td>Self-reported daily IG/FB use T3</td>
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<td>100.54</td>
</tr>
<tr>
<td>Self-reported daily IG/FB use T4</td>
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</tr>
<tr>
<td>MFIS T1</td>
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<tr>
<td>MFIS T2</td>
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<td>.80</td>
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<tr>
<td>MFIS T3</td>
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<td>.82</td>
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<tr>
<td>MFIS T4</td>
<td>2.81</td>
<td>.86</td>
</tr>
<tr>
<td>Variables</td>
<td>IG/FB Not Blocked</td>
<td>IG/FB Blocked</td>
</tr>
<tr>
<td>---------------------</td>
<td>------------------</td>
<td>--------------</td>
</tr>
<tr>
<td>SCRS T1</td>
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<td>53.82</td>
</tr>
<tr>
<td>SCRS T2</td>
<td>52.60</td>
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</tr>
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<td>INCOM T1</td>
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</tr>
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<td>INCOM T2</td>
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<td>3.27</td>
</tr>
<tr>
<td>INCOM T3</td>
<td>3.42</td>
<td>3.32</td>
</tr>
<tr>
<td>INCOM T4</td>
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<td>3.35</td>
</tr>
<tr>
<td>Passive IG/FB use T1</td>
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<td>3.59</td>
</tr>
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<td>Passive IG/FB use T2</td>
<td>3.17</td>
<td>2.48</td>
</tr>
<tr>
<td>Passive IG/FB use T3</td>
<td>3.00</td>
<td>2.77</td>
</tr>
<tr>
<td>Passive IG/FB use T4</td>
<td>2.99</td>
<td>2.57</td>
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<tr>
<td>Positive Affect T1</td>
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<tr>
<td>Positive Affect T4</td>
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<tr>
<td>PT Connection T1</td>
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<td>PT Connection T3</td>
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<td>PT Connection T4</td>
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<td>PT Emo Given T1</td>
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</tr>
<tr>
<td>PT Emo Given T4</td>
<td>.09</td>
<td>.06</td>
</tr>
</tbody>
</table>

Note. IG/FB = Instagram and Facebook; MFIS = Multidimensional Facebook Intensity Scale; SCRS = Social Comparison Rating Scale; INCOM = Iowa-Netherlands Comparison Orientation Measure; PT Connection = Participant posts evidencing connection; PT Emo Given = Participant posts evidencing emotional support given
COVID-19

Due to the necessity to engage in physical distancing, the COVID-19 pandemic may have impacted not only the frequency in which people use social media platforms (Thygesen et al., 2021) but also the way in which they engage with social media like FB and IG. As data collection for this study began in 2019, 27% \((n = 106)\) of the sample completed the study prior to the COVID-19 pandemic. I chose March 16, 2020, as the cut-off as this was the date on which UBC officially announced work-from-home protocols for all staff and students. I examined any group differences (using a series of \(t\)-tests) in the IG/FB variables between participants that completed the study prior to the beginning of the COVID-19 pandemic and participants who had any part of their participation occurring during the pandemic. There were no significant group differences, so I decided not to include this variable as a covariate.

Experimental Condition

The current data were drawn from a larger study aimed at changing participants’ IG/FB use and their psychopathology symptoms, where participants were randomized to one of three conditions: Tutorial \((n = 140)\), Fasting \((n = 126)\), or Control \((n = 133)\). I investigated whether the reciprocal associations between IG/FB use and psychopathology are the same across experimental conditions by running multiple groups analyses on each RI-CLPM and CLPM model. Specifically, I assessed the difference in model fit when the pathways between IG/FB use and psychopathology are constrained to be equal across the three experimental conditions, relative to a model where the pathways are free to vary. If the model fit did not significantly improve when pathways were free to vary, this suggested no moderation effects and supported collapsing across conditions. If the model fit of the constrained model was significantly worse than the free model, I fit the model to each condition separately.
Table 3 contains the results from the multi-group analyses. Imposing constraints where lagged parameters were invariant across experimental conditions was tenable in all but one model (passive IG/FB use and internalizing psychopathology). I discuss this in further detail in the model’s own sub-section. Thus, multi-group analyses revealed that, for the most part, the longitudinal associations between aspects of IG/FB use and psychopathology are the same regardless of the experimental condition to which the participants were assigned.
### Table 3

**Multi-Group Analyses Assessing Model Fit across Experimental Conditions**

<table>
<thead>
<tr>
<th>Model</th>
<th>$\Delta \chi^2$</th>
<th>$\Delta \text{df}$</th>
<th>$p$</th>
</tr>
</thead>
<tbody>
<tr>
<td>Observed weekly IG/FB use – Internalizing symptoms</td>
<td>44.22</td>
<td>32</td>
<td>.07</td>
</tr>
<tr>
<td>Self-reported daily IG/FB use – Internalizing symptoms</td>
<td>35.18</td>
<td>32</td>
<td>.32</td>
</tr>
<tr>
<td>MFIS – Internalizing symptoms</td>
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<tr>
<td>SCRS – Internalizing symptoms</td>
<td>38.19</td>
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<td>.21</td>
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<tr>
<td>INCOM – Internalizing symptoms</td>
<td>28.99</td>
<td>32</td>
<td>.62</td>
</tr>
<tr>
<td>Passive IG/FB use – Internalizing symptoms</td>
<td>55.94</td>
<td>32</td>
<td>.01</td>
</tr>
<tr>
<td>Quality of IG/FB use – Internalizing symptoms</td>
<td>26.07</td>
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<td>Observed weekly IG/FB use – ADHD</td>
<td>10.47</td>
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</tr>
<tr>
<td>Quality of IG/FB use – ADHD</td>
<td>13.70</td>
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<td>.09</td>
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</table>

*Note.* IG/FB = Instagram and Facebook; MFIS = Multidimensional Facebook Intensity Scale; SCRS = Social Comparison Rating Scale; INCOM = Iowa-Netherlands Comparison Orientation Measure

*a* $\chi^2$ difference testing using Satorra-Bentler scaled chi-squared tests.
Results

Descriptive Results

Descriptive statistics for variables of interest are presented in Table 4. As expected of longitudinal data, the percentage of missing values increased across measurement timepoints, with 81% of individuals who participated at T1 completing T4. Missing data were handled using Full Information Maximum Likelihood (FIML) estimation, and a maximum likelihood robust (MLR) estimator was selected to account for potential issues of non-normal data.
### Table 4

*Descriptive Statistics*

<table>
<thead>
<tr>
<th>Variables</th>
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<th>Kurtosis</th>
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<td>25.53</td>
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<td>ADHD T1</td>
<td>383</td>
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<td>.55</td>
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<td>ADHD T4</td>
<td>309</td>
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<td>.60</td>
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<td>297.47</td>
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<td>.31</td>
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<td>.08</td>
<td>.16</td>
<td>2.06</td>
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*Note. IG/FB = Instagram and Facebook; MFIS = Multidimensional Facebook Intensity Scale; SCRS = Social Comparison Rating Scale; INCOM = Iowa-Netherlands Comparison Orientation Measure; PT Connection = Participant posts evidencing connection; PT Emo Given = Participant posts evidencing emotional support given*
Measurement Models

Quantity of IG/FB Use

The three measures included in the CFA as potential indicators of a latent variable of quantity of IG/FB use were: self-reported daily IG/FB use, the mean score on self-reported IG/FB intensity (MFIS) and observed weekly IG/FB use.

Measurement Model for 4-wave RI-CLPM. A longitudinal 4-factor CFA model (representing the four timepoints) had excellent approximate fit after the addition of residual correlations among the same indicators across time ($\chi^2(30) = 31.42, p = .40, CFI = .999, RMSEA = .011, SRMR = .022$). When factor loadings were constrained to be invariant over time ($\chi^2(36) = 54.76, p = .02, CFI = .986, RMSEA = .037, SRMR = .047$), this resulted in a significantly poorer fitting model (Model comparison: $\Delta\chi^2(6) = 25.83, p < .001$). As such, metric invariance could not be established.

Measurement Model for 2-wave CLPM. A longitudinal 2-factor CFA model demonstrated excellent model fit with the addition of correlated residuals across timepoint waves for self-reported IG/FB intensity (MFIS) and observed weekly IG/FB use ($\chi^2(6) = 4.77, p = .57, CFI = 1.000, RMSEA = .000, SRMR = .020$). When factor loadings were constrained to be invariant across the two waves ($\chi^2(8) = 26.92, p < .001, CFI = .928, RMSEA = .078, SRMR = .061$), the constraints imposed resulted in a significantly poorer fitting model (Model comparison: $\Delta\chi^2(2) = 28.73, p < .001$). Metric invariance could not be established.

IG/FB Behaviours

There were three measures included in the CFA as potential indicators for IG/FB behaviours: the degree of social comparison (INCOM), the direction of social comparison (SCRS), and passive IG/FB use.
Measurement Model for 4-wave RI-CLPM. A longitudinal 4-factor CFA model demonstrated excellent model fit with the addition of correlated residuals across timepoint waves for the direction of social comparison (SCRS) and passive IG/FB use ($\chi^2$(37) = 47.85, $p = .109$, $CFI = .990$, $RMSEA = .028$, $SRMR = .069$). Constraining factor loadings to be invariant over time ($\chi^2$(43) = 67.29, $p = .010$, $CFI = .978$, $RMSEA = .039$, $SRMR = .095$), resulted in a significantly poorer fitting model (Model comparison: $\Delta \chi^2$(6) = 19.46, $p < .001$), so metric invariance could not be established. After specifying and implementing the CFA model, it came to my attention that the indicators specified in my analysis were incorrectly treated as reflective indicators (observed variables that are effects or consequences of latent variables) rather than formative indicators (observed variables that affect or define the latent variable). An assumption of CFA models is that an underlying latent factor is thought to directly affect its indicators (Bollen, 2002). However, in my study, the indicators of degree and direction of social comparison as well as passive IG/FB use are better conceptualized as defining a latent factor of social comparison behaviours rather than the reverse. I acknowledge that incorrectly specifying indicators as reflective when they are in fact formative can lead to issues with misspecification (Bollen & Lennox, 1991). This may partially explain why I was unable to specify the measurement model I had initially proposed. In such cases, it is recommended that observed variables be examined within their own separate models.

Quality of IG/FB Use

The initial CFA model for quality of IG/FB use was indicated by a total of 18 possible observed indicators, all from the observational coding system of participants’ IG and FB pages: positive emotion; negative emotion; connection in participant posts, friend posts, participants comments, and friend comments; emotional support given in participant posts, friend posts,
participant comments, and friend comments; verbal aggression in participant posts, friend posts, participants comments, and friend comments; and deviant content observed in participant posts, friend posts, participants comments, and friend comments.

**Measurement Model for 4-wave RI-CLPM.** The initial specified model resulted in issues with convergence and poor model fit, even with modifications to the model. Examination of descriptive statistics revealed that a number of the relationship quality codes initially included in the CFA had large amounts of missing data (69-92%), near-zero variance, and low occurrence, which made them unsuitable for a CFA. This occurred for several reasons. First, as participants’ IG/FB were observationally coded in four 2-week segments, this was insufficient time for some participants to have new content on their IG/FB at one or more timepoints. Second, certain variables, such as content posted by friends or indicators of negative interaction quality occurred infrequently. This may be representative of emerging adults’ IG/FB experiences in general. As I was only able to observe content that was posted on participants’ pages and posts in which they were tagged, I likely missed interactions between participants and their network that occurred on friends’ pages or in private direct message (DM) exchanges. In addition, due to the bias for positively-valenced content on IG/FB, I would expect the frequency of negative interaction codes such as verbal aggression to be low.

Removal of these variables from analyses resulted in four remaining candidate indicators (positive affect, negative affect, participant posts evidencing connection, and participant posts evidencing emotional support). A series of exploratory factor analyses (EFA; one for each timepoint) of the four variables, using principal components rotation, yielded a one-factor solution. However, closer examination of the component matrix revealed that factor loadings for negative affect were substantially lower than the other three variables across all timepoints; this
was supported by the low communalities observed for negative affect. After consideration, I decided on a three-indicator latent factor solution for my RI-CLPM and CLPM analyses, comprising of positive affect, participant posts evidencing connection, and participant posts evidencing emotional support.

Notably, I had initially conceptualized quality of IG/FB use to reflect the observed positive bond, warmth, and support between the participant and members of their online social network. However, upon further consideration, I acknowledge that the observed variables I had originally selected and specified in the proposed CFA model would be better treated as formative rather than reflective indicators (such as with the latent IG/FB behaviours factor discussed above; Bollen, 2002). It could be that my final latent quality of IG/FB use factor (specified by participant positive affect, and participant posts evidencing emotional support and connection), which may be capturing positive self-presentation on IG and FB, was more suitable for a CFA, such that these three indicators may be reflective of an underlying positive self-presentation factor. Nonetheless, I also note that the changes to the variables ultimately included in this final latent quality of IG/FB use factor changed the meaning of the construct in my study from how I had conceptualized it in previous sections.

A longitudinal 4-factor CFA model for quality of IG/FB use indicated by positive affect, participant posts evidencing connection, and participant posts evidencing emotional support demonstrated good model fit ($\chi^2(48) = 57.97, \ p = .15, \ CFI = .950, \ RMSEA = .029, \ SRMR = .079$). Constraining factor loadings to be invariant across timepoints ($\chi^2(54) = 57.12, \ p = .360, \ CFI = .984, \ RMSEA = .016, \ SRMR = .080$) resulted in model fit that was not significantly different from the model in which factor loadings were free to vary over time (Model comparison: $\Delta\chi^2(6) = .73, \ p = .99$). Thus, measurement invariance was established.
**Measurement Model for two-wave CLPM.** A longitudinal 2-factor CFA model indicated by positive affect, participant posts evidencing connection, and participant posts evidencing emotional support demonstrated acceptable model fit ($\chi^2(8) = 13.12, p = .108, CFI = .894, RMSEA = .058, SRMR = .051$). Constraining factor loadings to be invariant across timepoints ($\chi^2(10) = 10.07, p = .435, CFI = .999, RMSEA = .006, SRMR = .054$) resulted in model fit that was not significantly different from the model in which factor loadings were free to vary over time (Model comparison: $\Delta \chi^2(2) = .13, p = .939$), so, measurement invariance was established.

**Bidirectional Relationships Between Internalizing Psychopathology and IG/FB Use**

*(Hypotheses 1a, 1b, and 1c)*

**Hypothesis 1a: Internalizing Psychopathology and Quantity of IG/FB Use**

Because the specified measurement model for quantity of IG/FB use failed to establish measurement invariance (see above), I elected to run separate RI-CLPM models for self-reported daily IG/FB use (see Figure 7), self-reported IG/FB intensity (MFIS; see Figure 8) and observed weekly IG/FB use (see Figure 9). I note that all statistically significant cross-lagged paths survived Benjamini-Hochberg corrections for multiple analyses.

**Self-Reported Daily IG/FB Use.** The basic RI-CLPM showed good model fit ($\chi^2(17) = 20.73, p = .239, CFI = .994, RMSEA = .024, SRMR = .047$). The addition of country of origin as a covariate to the model also resulted in a good fit ($\chi^2(23) = 30.98, p = .123, CFI = .988, RMSEA = .032, SRMR = .047$) and was thus retained.

As shown in Figure 7, at the between-person level, self-reported daily IG/FB use was not significantly correlated with internalizing psychopathology. Originating from a country in which IG/FB is blocked was correlated with less self-reported daily IG/FB use and lower internalizing
psychopathology. At the within-person level, only the autoregressive path for self-reported daily IG/FB use was significant. That is, positive deviations in a participant’s expected self-reported daily IG/FB use score (indicating more daily use) at one timepoint predicted a positive deviation at a subsequent timepoint. With regard to the cross-lagged paths, a positive deviation in self-reported daily IG/FB use at an initial timepoint was associated with a positive deviation in internalizing psychopathology at a subsequent timepoint. The cross-lagged path from internalizing psychopathology at an initial timepoint to self-reported daily IG/FB use at a subsequent timepoint was non-significant.

**Figure 7**

RI-CLPM of Associations Between Daily IG/FB Use and Internalizing Psychopathology

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**Notes.** Self = Self-reported daily IG/FB use; Int = Internalizing psychopathology. Standardized estimates are shown.

* p < .05, ** p < .01

**Self-Reported IG/FB Intensity (MFIS).** The basic RI-CLPM showed good model fit with the addition of a lagged path from the within-components of IG/FB intensity (MFIS) at T2 to T4 ($\chi^2 (16) = 35.27, p = .004$, $CFI = .983$, $RMSEA = .056$, $SRMR = .056$). The addition of country of origin as a covariate to the model also resulted in good fit ($\chi^2 (22) = 42.82, p = .005$, $CFI = .982$, $RMSEA = .052$, $SRMR = .053$) and was thus retained.
As shown in Figure 8, at the between-person level, IG/FB intensity was not significantly correlated with internalizing psychopathology. Originating from a country in which IG/FB is blocked was correlated with lower IG/FB intensity scores and lower internalizing psychopathology. At the within-person level, only the autoregressive path for IG/FB intensity was significant. That is, positive deviations in a participant’s expected IG/FB intensity score (indicating more daily use) at one timepoint predicted a positive deviation in IG/FB intensity at a subsequent timepoint. For the cross-lagged paths, a positive deviation in a participant’s IG/FB intensity score at an initial timepoint was associated with a positive deviation in internalizing psychopathology at a subsequent timepoint. The cross-lagged path from internalizing psychopathology at an initial timepoint to IG/FB intensity at a subsequent timepoint was non-significant.

**Figure 8**

*RI-CLPM for IG/FB Intensity and Internalizing Psychopathology*

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**Notes.** MFIS = Multidimensional Facebook Intensity Scale; Int = Internalizing psychopathology. Standardized estimates are shown.

* $p < .05$, ** $p < .01$
Observed Weekly IG/FB Use. The basic RI-CLPM showed good model fit ($\chi^2(17) = 29.00, p = .035, CFI = .985, RMSEA = .043, SRMR = .045$). The addition of country of origin as a covariate to the model also resulted in good fit ($\chi^2(23) = 33.25, p = .077, CFI = .987, RMSEA = .036, SRMR = .043$), and was thus retained.

As shown in Figure 9, at the between-person level, observed weekly IG/FB use was not significantly correlated with internalizing psychopathology. Originating from a country in which IG/FB is blocked was correlated with less observed weekly IG/FB use and lower internalizing psychopathology. At the within-person level, the autoregressive path for observed weekly IG/FB use was significant. That is, observed weekly IG/FB use at one timepoint positively predicted the same construct at a subsequent timepoint. Regarding the cross-lagged paths, a positive deviation from a participant’s expected observed weekly IG/FB use at an initial timepoint predicted a positive deviation in their internalizing psychopathology at a subsequent timepoint. The lagged path from internalizing psychopathology at an initial timepoint to observed weekly IG/FB use at a subsequent timepoint was non-significant.
Figure 9

RI-CLPM for Weekly IG/FB Use and Internalizing Psychopathology

Notes. Week = Observed weekly IG/FB use; Int = Internalizing psychopathology. Standardized estimates are shown. * $p < .05$, ** $p < .01$

**Hypothesis 1b: Internalizing Psychopathology and IG/FB Behaviours**

The specified measurement model for IG/FB behaviours failed to establish measurement variance (see above). Thus, I ran separate RI-CLPM models for the degree of social comparison (INCOM; see Figure 10), the direction of social comparison (SCRS; see Figure 11), and passive IG/FB use (see Figure 12). All statistically significant cross-lagged paths survived Benjamini-Hochberg corrections for multiple analyses.

**Degree of Social Comparison (INCOM).** The basic RI-CLPM showed good model fit with the addition of correlated residuals between the within-components of the degree of social comparison (INCOM) at T2 and T4 ($\chi^2(16) = 20.11, p = .215, CFI = .996, RMSEA = .025, SRMR = .046$). The addition of country of origin as a covariate to the model also resulted in a good fit ($\chi^2(22) = 26.61, p = .226, CFI = .995, RMSEA = .024, SRMR = .044$) and was thus retained.

As shown in Figure 10, at the between-person level, degree of social comparison was positively correlated with internalizing psychopathology. Originating from a country in which
IG/FB is blocked was also correlated with lower internalizing psychopathology. At the within-person level, the autoregressive paths for degree of social comparison were significant. That is, the degree of social comparison at one timepoint positively predicted the same construct at a subsequent timepoint. The autoregressive paths for internalizing psychopathology were also significant and positive, except for the path from internalizing psychopathology at T1 to T2, which was not significant. With regard to the cross-lagged paths, a positive deviation from a participant’s expected degree of social comparison score at an initial timepoint was associated with a positive deviation in internalizing psychopathology at a subsequent timepoint. A positive deviation in internalizing psychopathology at an initial timepoint also predicted a positive deviation in degree of social comparison at a subsequent timepoint. This suggests the presence of a bidirectional relationship between degree of social comparison and internalizing psychopathology.

**Figure 10**

*RI-CLPM for Degree of Social Comparison and Internalizing Psychopathology*

![RI-CLPM Diagram]

**Notes.** INCOM = Iowa-Netherlands Comparison Orientation Measure; Int = Internalizing psychopathology. Standardized estimates are shown.

* p < .05, ** p < .01
Direction of Social Comparison (SCRS). The basic RI-CLPM demonstrated good model fit ($\chi^2(17) = 29.23, p = .033$, $CFI = .985$, $RMSEA = .042$, $SRMR = .059$). The addition of country of origin as a covariate to the model also resulted in a good fit ($\chi^2(23) = 39.94, p = .016$, $CFI = .995$, $RMSEA = .024$, $SRMR = .044$) and was thus retained.

As shown in Figure 11, at the between-person level, the direction of social comparison (SCRS) was negatively correlated with internalizing psychopathology, such that viewing oneself more negatively relative to others (i.e., upwards social comparisons) was associated with greater internalizing symptomatology. Originating from a country in which IG/FB is blocked was also correlated with lower internalizing psychopathology. At the within-person level, neither the autoregressive paths for direction of social comparison nor internalizing psychopathology were significant. For the cross-lagged paths, a positive deviation in a participant’s internalizing psychopathology at an initial timepoint was associated with a negative deviation in their SCRS scores (indicating a more negative view of self when compared to others) at a subsequent timepoint. The cross-lagged path from direction of social comparison at an initial timepoint to internalizing psychopathology at a subsequent timepoint was non-significant.
**Figure 11**

*RI-CLPM for Direction of Social Comparison and Internalizing Psychopathology*

![Diagram](image)

*Notes. SCRS = Social Comparison Rating Scale; Int = Internalizing psychopathology. Standardized estimates are shown.*

* p < .05, ** p < .01

**Passive IG/FB Use.** Results from the multi-group analysis revealed that the model in which all lagged parameters were constrained to be equal across all three experimental conditions resulted in a significantly worse fit, compared to a model in which lagged parameters were free to vary across condition (Model comparison: $\Delta \chi^2(32) = 55.936, p = .006$). In order to determine the source of this model misfit, I fit the general RI-CLPM model to each condition independently. I found that this model fit well in the Tutorial condition and Control condition, but not in the Fasting condition. This suggested that this model be fitted only to participants in the Tutorial and Control conditions.

The basic RI-CLPM demonstrated good model fit ($\chi^2(17) = 27.76, p = .048, CFI = .982, RMSEA = .048, SRMR = .045$). The addition of country of origin as a covariate to the model also resulted in a good fit ($\chi^2(23) = 39.69, p = .017, CFI = .972, RMSEA = .054, SRMR = .050$) and was thus retained.

As shown in Figure 12, at the between-person level, passive IG/FB use was not
significantly associated with internalizing psychopathology. Originating from a country in which IG/FB is blocked was correlated with less passive IG/FB use and lower internalizing psychopathology. At the within-person level, the autoregressive paths for passive IG/FB use were significant. That is, a positive deviation in a participant’s expected passive IG/FB use score (indicating more passive IG/FB use use) at one timepoint predicted a positive deviation in the same construct at a subsequent timepoint. Neither the cross-lagged paths from initial passive IG/FB use to subsequent internalizing psychopathology, or initial internalizing psychopathology to subsequent passive IG/FB use were significant.

**Figure 12**

*RI-CLPM for Passive IG/FB Use and Internalizing Psychopathology*

![Diagram](image)

**Notes.** Pass = Passive IG/FB Use; Int = Internalizing psychopathology. Standardized estimates are shown.

* *p < .05, **p < .01

**Hypothesis 1c: Internalizing Psychopathology and Quality of IG/FB Use**

Using the latent variable of quality of IG/FB use specified in the measurement model above, the basic RI-CLPM showed good model fit ($\chi^2(95) = 116.86$, $p = .064$, $CFI = .973$, $RMSEA = .024$, $SRMR = .07$). However, this model also resulted in a latent variable covariance matrix that was non-positive definite, and closer examination of model diagnostics in Mplus.
output revealed a correlation between the within-person components of quality of IG/FB use at T3 and T4 that was larger than 1. This suggested that despite showing good approximate fit, the model specified may not be suitable for the data, potentially because there was very little change in quality of IG/FB use from T3 to T4. As the RI-CLPM methodology is designed to investigate change over time, the lack of variability from one timepoint to another may result in problematic parameter estimates. Thus, I attempted to run this model for 3 timepoints (T1 to T3) rather than 4.

This modified RI-CLPM with only 3 timepoints resulted in good model fit ($\chi^2(51) = 67.09, p = .065, CFI = .971, RMSEA = .028, SRMR = .068$). The addition of country of origin as a covariate to the model also resulted in good fit ($\chi^2(61) = 85.14, p = .022, CFI = .96, RMSEA = .033, SRMR = .070$) and was thus retained.

As shown in Figure 13, at the between-person level, quality of IG/FB use was not correlated with internalizing psychopathology. Originating from a country in which IG/FB are blocked was correlated with lower quality of IG/FB use and lower internalizing psychopathology. At the within-person level, only the autoregressive path for internalizing psychopathology from T1 to T2 was significant and positive. Regarding the cross-lagged paths, a positive deviation in a participant’s quality of IG/FB use at an initial timepoint was associated with a positive deviation in their internalizing psychopathology at a subsequent timepoint. The cross-lagged paths from internalizing psychopathology at an initial timepoint to quality of IG/FB use at a subsequent timepoint was non-significant. All statistically significant cross-lagged paths survived Benjamini-Hochberg corrections for multiple analyses.
Bidirectional Relationships between ADHD Symptomatology and IG/FB Use (Hypotheses 2a and 2b)

**Hypothesis 2a: ADHD Symptomatology and Quantity of IG/FB Use**

As discussed above, because the specified measurement model for quantity of IG/FB use failed to establish measurement invariance, I ran separate CLPM models for self-reported daily IG/FB use (see Figure 14), self-reported IG/FB intensity (MFIS; see Figure 15) and observed weekly IG/FB use (see Figure 16). All statistically significant cross-lagged paths survived Benjamini-Hochberg corrections for multiple analyses.

**Self-Reported Daily IG/FB Use.** The unconstrained CLPM specified was fully saturated (there were no restrictions imposed on the variance and covariance matrix), and as such, fit indices for this model could not be examined, as by definition, this model fits the data perfectly. The addition of country of origin as a covariate to the model resulted in excellent fit ($\chi^2(2) = 1.93$, $p = .318$, $CFI = 1.00$, $RMSEA = .00$, $SRMR = .011$) and was thus retained.
As shown in Figure 14, self-reported IG/FB use at T1 positively predicted the same construct at T4. The autoregressive path for ADHD symptomatology from T1 to T4 was also significant and positive. With regard to the cross-lagged paths, participants’ self-reported IG/FB use at T1 negatively predicted their ADHD symptoms at T4. The cross-lagged path from ADHD symptomatology at T1 to self-reported IG/FB use at T4 was non-significant. Originating from a country in which IG/FB are blocked was also correlated with less self-reported daily IG/FB use at both T1 and T4.

**Figure 14**

*CLPM for Daily IG/FB Use and ADHD Symptomatology*

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**Notes.** Self = Self-reported daily IG/FB use; ADHD = ADHD Symptomatology. Standardized estimates are shown.

* *p < .05, ** p < .01

**Self-Reported IG/FB Intensity (MFIS).** The unconstrained CLPM specified was fully saturated. The addition of country of origin as a covariate to the model resulted in a good fit ($\chi^2(2) = 3.21, p = .201, CFI = .995, RMSEA = .042, SRMR = .019$) and was thus retained.

As shown in Figure 15, participants’ IG/FB intensity (MFIS) scores at T1 positively predicted the same construct at T4. The autoregressive path for ADHD symptomatology from T1 to T4 was also significant and positive. Neither the cross-lagged paths from IG/FB intensity at
T1 to ADHD symptomatology at T4, or ADHD symptomatology at T1 to IG/FB intensity at T4 were significant. Originating from a country in which IG/FB are blocked was also correlated with lower IG/FB intensity scores at both T1 and T4.

**Figure 15**

*CLPM for IG/FB Intensity and ADHD Symptomatology*

![Diagram showing relationships between ADHD, MFIS, IG/FB intensity, and ADHD symptomatology over time.](attachment:diagram.png)

*Notes. MFIS = Multidimensional IG/FB Intensity Scale; ADHD = ADHD Symptomatology. Standardized estimates are shown. *p < .05, **p < .01*

**Observed Weekly IG/FB Use.** The unconstrained CLPM specified was fully saturated. The addition of country of origin as a covariate to the model resulted in a good fit ($\chi^2(2) = 3.07, p = .215$, $CFI = .994$, $RMSEA = .039$, $SRMR = .016$) and was thus retained.

As shown in Figure 16, observed IG/FB use at T1 positively predicted the same construct at T4. The autoregressive path for ADHD symptomatology from T1 to T4 was also significant and positive. Neither the cross-lagged paths from observed IG/FB use at T1 to ADHD symptomatology at T4, or ADHD symptomatology at T1 to observed IG/FB use at T4 were significant. Originating from a country in which IG/FB are blocked was also correlated with less observed weekly IG/FB use at both T1 and T4.
Hypothesis 2b: ADHD Symptomatology and Quality of IG/FB Use

Using the latent variable of quality of IG/FB use established in the measurement model (see above), the unconstrained CLPM demonstrated good model fit ($\chi^2(18) = 18.66, p = .413, CFI = .996, RMSEA = .010, SRMR = .053$). The addition of country of origin as a covariate to the model also resulted in a good fit ($\chi^2(24) = 25.91, p = .358, CFI = .988, RMSEA = .015, SRMR = .059$) and was thus retained. All statistically significant cross-lagged paths survived Benjamini-Hochberg corrections for multiple analyses.

As shown in Figure 17, quality of IG/FB use at T1 positively predicted the same construct at T4. The autoregressive path for ADHD symptomatology from T1 to T4 was also significant and positive. The cross-lagged path from quality of IG/FB use at T1 positively predicted ADHD symptoms at T4. The path from ADHD symptomatology at T1 to quality of IG/FB use at T4 was non-significant. Originating from a country in which IG/FB are blocked was not correlated with either ADHD symptomatology or quality of IG/FB use.
Figure 17

CLPM for Quality of IG/FB Use and ADHD Symptomatology

![Diagram](image)

Notes. Qual = Quality of IG/FB Use; ADHD = ADHD Symptomatology. Standardized estimates are shown.
* $p < .05$, ** $p < .01$

Mediation Analyses (Hypotheses 3a, 3b, 3c, and 3d)

**Hypotheses 3a: Quantity of IG/FB Use Mediating ADHD Symptoms to Internalizing Psychopathology**

As the specified measurement model for the quantity of IG/FB use was fully saturated, fit indices could not be examined. The structural model with country of origin and internalizing psychopathology at T1 as covariates resulted in acceptable model fit ($\chi^2(11) = 22.11$, $p = .024$, CFI = .959, RMSEA = .053, SRMR = .045). Both the direct effect from ADHD symptoms at T1 to internalizing psychopathology at T4, (Est. = -.08, SE =.06, p = .19), and the indirect effect through quantity of IG/FB use were non-significant (Est. = .02, SE =.01, p = .10).

**Hypotheses 3b: Quality of IG/FB Use Mediating ADHD Symptoms to Internalizing Psychopathology**

As the specified measurement model for the quality of IG/FB use was fully saturated, fit indices could not be examined. The structural model with country of origin and internalizing psychopathology at T1 as covariates resulted in acceptable model fit ($\chi^2(11) = 22.11$, $p = .024$, CFI = .959, RMSEA = .053, SRMR = .045). Both the direct effect from ADHD symptoms at T1 to internalizing psychopathology at T4, (Est. = -.08, SE =.06, p = .19), and the indirect effect through quality of IG/FB use were non-significant (Est. = .02, SE =.01, p = .10).
psychopathology at T1 as covariates resulted in excellent model fit ($\chi^2(11) = 15.24, p = .17, CFI = .98, RMSEA = .033, SRMR = .047$). Both the direct effect from ADHD symptoms at T1 to internalizing psychopathology at T4 (Est. = -.06, SE =.06, $p = .30$) and the indirect effect through quality of IG/FB use were non-significant (Est. = .00, SE =.00, $p = .96$).

**Hypotheses 3c: Quantity of IG/FB Use Mediating Internalizing Psychopathology to ADHD Symptoms**

As the specified measurement model for the quantity of IG/FB use was fully saturated, fit indices for this CFA model could not be examined. The structural model with country of origin and ADHD symptoms at T1 as covariates resulted in acceptable model fit ($\chi^2(11) = 14.84, p = .19, CFI = .982, RMSEA = .031, SRMR = .044$). There was a significant direct effect from internalizing psychopathology at T1 to ADHD symptoms at T4 (Est. = .16, SE =.06, $p = .01$), suggesting higher internalizing symptoms at T1 predicted higher ADHD symptoms at T4 (after accounting for T1 ADHD symptoms). However, the indirect effect through quantity of IG/FB use was non-significant (Est. = .00, SE =.00, $p = .82$).

**Hypotheses 3d: Quality of IG/FB Use Mediating Internalizing Psychopathology to ADHD Symptoms**

As the measurement model for quality of IG/FB use was fully saturated, fit indices could not be examined. The structural model with country of origin and ADHD symptoms at T1 as covariates resulted in acceptable model fit ($\chi^2(11) = 30.84, p = .00, CFI = .93, RMSEA = .07, SRMR = .06$). Although there was a significant positive direct effect from internalizing psychopathology at T1 to ADHD symptoms at T4 (Est. = .16, SE =.06, $p = .01$), the indirect effect through quality of IG/FB use was non-significant (Est. = .00, SE =.00, $p = .18$).
Discussion

The current study tested bidirectional associations between aspects of psychopathology and dimensions of IG/FB use in a non-clinical sample of 399 emerging adults who reported elevations in psychopathology symptoms and perceived their IG/FB use to have at least some negative impact on their lives. There were four study timepoints, each spaced 2 weeks apart.

My first aim was to investigate the reciprocal associations between internalizing psychopathology and dimensions of IG/FB use, namely quantity of use, IG/FB behaviours, and quality of use. I found that only the degree of online social comparison had a bidirectional relationship with internalizing psychopathology over time (where more frequent social comparison predicted higher internalizing psychopathology and vice versa). Regarding unidirectional paths, greater quantity and higher quality of IG/FB use predicted higher internalizing psychopathology. Additionally, higher internalizing psychopathology was associated with more social comparison (specifically in the upwards direction) later. The size of cross-lagged effects between internalizing psychopathology and IG/FB use ranged from medium to large (Orth et al., 2022).

My second aim was to test reciprocal associations between ADHD symptoms and both quantity and quality of IG/FB use. I found no significant associations between quantity of IG/FB use and ADHD symptoms, with the exception that more self-reported daily IG/FB use was negatively related to subsequent ADHD symptoms, which did not align with my initial hypothesis. Higher quality of IG/FB use predicted higher ADHD symptom levels later. The size of cross-lagged effects between ADHD symptoms and IG/FB use were large (Orth et al., 2022).

My third aim explored the quantity and quality of IG/FB use as mediators of the longitudinal links between internalizing psychopathology and ADHD symptoms. Although
higher initial internalizing psychopathology predicted higher ADHD symptoms later (though higher ADHD symptoms did not predict subsequent internalizing psychopathology), I found no significant mediation effects through IG/FB use.

**IG/FB Use and Internalizing Psychopathology**

These models used the RI-CLPM to separate variance at the between-person level from the within-person level. Therefore, all findings are interpreted as a participant’s relative deviation from their typical level of internalizing psychopathology as predicting future deviations in that participant’s usual level of IG/FB use (and vice versa).

**Quantity of IG/FB Use**

Overall, when participants used a greater quantity of IG/FB, they reported experiencing more internalizing symptoms 2 weeks later, after accounting for their internalizing psychopathology at a previous timepoint and country of origin. This pattern of results was similar across the three different measures of quantity of IG/FB use (self-reported daily screentime use, self-reported intensity of IG/FB use, and observed weekly screentime use).

These findings are consistent with existing cross-sectional and longitudinal (Primack et al., 2021; Yoon et al., 2019) work suggesting that greater quantity of IG/FB use predicts increased internalizing symptoms. The current study is also unique in that I included both self-reported and observed measures of quantity of IG/FB use, all of which showed similar associations, increasing my confidence in the presence of this directional link.

There are several potential explanations for this pattern of results. First, it is possible that the quantity of IG/FB use may impact internalizing psychopathology via increased social comparison behaviour (Steers et al., 2014). A unique characteristic of IG/FB environments is the emphasis on visualness (Nesi et al., 2018), which reinforces the posting of positively-biased
content. The constant exposure to idealized content from an online social network has been thought to lead to increased engagement in upward social comparisons that contribute to increased internalizing psychopathology (McCarthy & Morina, 2020). When examined in my study post hoc, I found some support for this explanation, such that the frequency of online social comparisons mediated the association between self-reported intensity of IG/FB use (but not self-reported or observed quantity of IG/FB use) and subsequent internalizing psychopathology.

Another potential explanation could be that the increased use of IG/FB serves to displace other activities (either in-person or online) that might otherwise contribute to improved mood and less anxiety, such as exercise or time spent connecting with loved ones (S. M. Coyne et al., 2020). However, recent work examining this theoretical assumption has found little evidence to support the displacement hypothesis (Hall et al., 2019; Hall & Liu, 2022). Alternatively, excessive use of IG/FB may manifest as a form of avoidance behaviour, which provides temporary relief from negative emotions in the immediate short-term, but may make the person feel worse in the long-term (Hames et al., 2013; Parsons et al., 2021). Quantity of IG/FB use may also impact internalizing symptoms by way of problematic sleep, resulting from nocturnal use of these platforms that interfere with users’ sleep quality (Shin et al., 2022; Tandon et al., 2020).

Contrary to my hypothesis, internalizing psychopathology did not predict subsequent quantity of IG/FB use. This runs counter to previous work that found that higher internalizing psychopathology led to increased quantity of use over time (Yoo & Jeong, 2017). Perhaps for individuals who already report elevations in internalizing psychopathology (such as the current study participants), increases in symptoms compared to their typical level may have different effects on the amount they are using IG/FB, depending on context. In some instances, people
who are experiencing more internalizing symptoms may increase their engagement with IG/FB as a form of affect regulation (Griffioen et al., 2021), such as by distracting themselves by browsing these platforms or by seeking interactions with their network online (where the demands may be lower relative to in-person interactions). At other times, the lack of motivation and energy that often accompanies internalizing symptoms might drive individuals to withdraw and avoid interactions on IG/FB, as they do in in-person settings (Mikami & Szwedo, 2016). These two contextually dependent reactions to increased internalizing psychopathology may explain my pattern of results. Indeed, it is unclear to what extent these findings might generalize either to a clinical sample, or to a non-clinical sample who were not elevated in psychopathology symptoms.

**IG/FB Behaviours**

**Social Comparison.** At the between-person level, emerging adults who engaged in a greater degree of social comparisons (regardless of the direction of these comparisons) relative to their peers were more likely to also report higher internalizing psychopathology. Once these between-person effects were accounted for, I found a bidirectional relationship between degree of social comparison and internalizing psychopathology. That is, when someone engaged in more social comparisons than they usually do, they also reported experiencing more internalizing symptoms 2 weeks later. This aligns with work in in-person contexts, where social comparison behaviours have been posited to play an important role in the development and maintenance of depression and anxiety disorders (McCarthy & Morina, 2020). Internalizing psychopathology also appeared to predict subsequent engagement in social comparisons, such that when someone experienced more internalizing psychopathology, they also engaged in greater social comparison 2 weeks later.
These results point to a reciprocal relationship, such that when individuals feel more depressed or anxious, they are also more likely to engage in social comparisons on IG/FB. This increased engagement in social comparisons in turn predicts the subsequent exacerbation of internalizing symptoms. My findings extend existing interpersonal theories of psychopathology that argue that individuals with internalizing psychopathology may engage in behaviours that serve to maintain or worsen their symptoms (Hames et al., 2013).

The degree to which someone engages in social comparisons online is different from someone’s tendency to make upward versus downward comparisons. Importantly, the measure of direction of social comparisons did not take into account the amount of social comparisons being made, only whether any comparisons made tended to be upward versus downward. I found that at the between-person level, those who tended to view themselves more negatively relative to others (i.e., upward social comparison) also reported more internalizing symptoms. At the within-person level, when people experienced more internalizing symptoms than usual at a previous timepoint, their social comparisons were more likely to be directed upwards at a later timepoint. These findings align with work in in-person settings which found that when people were more depressed and anxious, they also tended to view themselves as being worse off than their peers (Antony et al., 2005; McCarthy & Morina, 2020). According to self-verification theory, individuals selectively seek feedback from their environment in a way that aligns with their self-concept (Joiner, 1995). This suggests that when emerging adults are more depressed and anxious, they may process interactions and content on IG/FB in a way that confirms a negative self-view of being inferior to others.

Interestingly, in my data, the direction of social comparisons was not significantly associated with subsequent internalizing psychopathology. Thus, although both the degree and
direction of social comparisons were predicted by prior internalizing symptomatology, only
degree (and not direction) appeared to uniquely predict subsequent internalizing
symptomatology. This suggests that the overall tendency for individuals to compare themselves
with others may play a larger role in the development and maintenance of mood and anxiety
problems, relative to doing so in an upwards direction, at least on IG/FB.

Although individuals with internalizing symptoms are likely to seek feedback from their
environment in a way that confirms their negative self-perceptions, perhaps both the
confirmation and disconfirmation of these perceptions may have similar effects on symptoms. If
negative perceptions are confirmed, this can perpetuate a negative view of self, which
consequently maintains or exacerbates internalizing symptoms (McCarthy & Morina, 2020). If
negative perceptions are instead disconfirmed, this may reinforce the act of making social
comparisons in an effort to meet an external standard or evaluate one’s social rank (Crocker,
2002), leading to similar effects that are seen from excessive reassurance seeking in in-person
contexts (Hames et al., 2013). Indeed, Clerkin et al. (2013) found that young adults who engaged
in more reassurance seeking on FB experienced decreases in self-esteem 3 weeks later. Although
it may appear counterintuitive, viewing oneself as doing better than others may also be
detrimental to mood and anxiety. Rapee and Heimberg (1997) posited that individuals with
social anxiety who perform well socially or leave a positive impression may experience
increased anxiety as this creates a pressure for them to perform at this higher standard in the
future, lest they disappoint others. This fear of positive evaluation may then be an antecedent to
increased internalizing psychopathology (Weeks & Howell, 2012). In sum, the tendencies to
engage in more social comparisons, and to direct social comparisons upwards, are predicted by
internalizing symptoms. But examination of the opposite pathway suggests that making more
social comparisons (regardless of direction) predicted increases in subsequent internalizing psychopathology.

**Passive IG/FB Use.** Contrary to my hypothesis, passive IG/FB use was not associated with internalizing psychopathology either at the between-person or within-person level. However, I qualify this result by noting that the analyses conducted on passive IG/FB use included only the Tutorial and Control conditions, as the model could not be fitted to the Fasting condition. I speculate that because participants in the Fasting condition were instructed to completely abstain from using IG/FB, this naturally led to substantial reductions in passive IG/FB use. Even for participants who reduced their use as much as they could when total abstinence was not possible, IG/FB use may have been restricted only to essential activities, such as responding to messages, leaving little time to engage passively on these apps. Indeed, I found that the mean amount of passive use at Timepoint 2 (after participants had completed their first module associated with their condition) for participants in the Fasting condition ($M = 2.2$) was significantly lower than those in the Tutorial ($M = 3.5; p < .001$) or Control ($M = 3.5; p < .001$) conditions.

These findings contrast with earlier work that found passive IG/FB use to be related to more depressive symptoms (Verduyn et al., 2015) and anxiety (Shaw et al., 2015). However, there is equivocal support for the passive use hypothesis. A recent scoping review by Valkenburg and colleagues (2022) found that only 44% of studies found an association between passive use and indicators of negative well-being (e.g., depressive symptoms). It has been suggested that passive IG/FB use may have both negative or/and positive impacts on internalizing psychopathology, depending on the circumstances. In some cases, passive IG/FB use may increase the risk for social comparisons, leading to increased depressive and anxiety symptoms.
(Verduyn et al., 2017). However, passive use does not always result in social comparisons, as is borne out in the correlations between these two behaviours in my study ($r = .28$ to $.41$). In fact, passive IG/FB use has also been linked to feelings of inspiration and enjoyment when viewing the others’ content (Meier et al., 2020), which presumably may have a more positive (rather than negative) impact on mood.

The impact of passive IG/FB use may depend on a number of dispositional or situational factors, such as the type of content the user is passively viewing, the relationship between the poster and the viewer, and individual differences in how the content is interpreted (Valkenburg et al., 2021). For example, if an IG user who has concerns around their body-image encounters content displaying idealized body representations while scrolling, this may engage social comparison processes that can result in the exacerbation of internalizing symptoms. However, if a user who has no interest in cars encounters content posted by a close friend who purchased a new vehicle, the consumption of this content may not impact their mood and anxiety (or they may be happy for their friend).

**Quality of IG/FB Use**

Guided by literature in in-person social contexts, my initial conceptualization of quality of IG/FB use intended to capture the affective quality (or valence) of users’ experiences and relationships on IG and FB. In in-person settings, these aspects are typically assessed using self-report questionnaires, which although convenient, can lead to issues of shared method and response biases. To reduce these biases, I observationally coded content posted by participants as well as friends/followers, which resulted in a total of 18 indicators of quality. However, including all these indicators within a CFA resulted in issues with convergence and model fit. I wonder whether the latent “quality of IG/FB use” factor that was specified in my final analyses
(indicated by positive affect, and participant posts evidencing emotional support and connection) may be reflective of positive self-presentation in IG/FB content, which may be distinct from my initial conceptualization of quality of IG/FB use.

At the between-person level, my variable of quality of IG/FB use was not significantly related to internalizing psychopathology. At the within-person level, I found that when emerging adults had higher quality of IG/FB use, they reported increased internalizing symptomatology 2 weeks later. This finding runs counter to existing literature, finding that higher quality and positively-valenced IG/FB use is linked with less, not more internalizing psychopathology (Mikami et al., 2019). However, my discrepant results may be explained by the observation that my “quality of IG/FB use” factor in this study could be capturing how positively participants present themselves on their IG/FB pages, as opposed to the presence of warm, supportive, interpersonal relationships or interactions they engage in.

Given the bias for positively-valenced content on IG/FB (Lup et al., 2015; Qiu et al., 2012), users may experience constant pressure to present themselves in a positive light, even when this does not align with their authentic self-evaluations and experiences. Such pressure may be cognitively and emotionally demanding (Grieve & Watkinson, 2016), which may worsen internalizing symptoms, particularly for individuals who already have elevated psychopathology. In an experimental study, Bailey et al. (2020) found that participants who were asked to present themselves in an idealized way on FB reported greater negative affect and lower positive affect compared to participants who posted content that they considered authentic. Relatedly, work outside of social media environments have found that the perception of social pressure to experience (and by extension, express) positive mood states is linked with higher levels of internalizing symptomatology (Dejonckheere et al., 2022). Thus, to the extent that participants
may be posting positive content that does not align with their own authentic experience or
current state, they may show increased levels of internalizing symptoms.

Concerning the directional pathway from internalizing psychopathology to quality of
IG/FB use, I found no significant effects. This suggests that associations between emerging
adults’ internalizing psychopathology and the level of positivity in their IG/FB content may be
limited. Perhaps the social pressure to present oneself in a positive light is so powerful that
current mental health may have an insufficient impact on what users post or comment. It is also
possible that internalizing psychopathology may have a greater influence over negatively-
valenced, rather than positively-valenced content.

**IG/FB Use and ADHD Symptoms**

As ADHD symptoms were only measured over two timepoints (T1 and T4), this made
the RI-CLPM, which requires at least three timepoints, unsuitable for this data. Because I was
unable to disaggregate the trait-like between-person variance from the state-like within-person
variance, it is unclear to what extent my findings for ADHD symptoms were driven by between-
person differences or within-person processes. There are situations in which the direction of
between-person effects is different from within-person effects – leading to potentially biased
parameter estimates if researchers do not account for these differences (Hamaker et al., 2015).
Thus, I interpret these results with caution.

**Quantity of IG/FB Use**

I found no significant directional associations between two of my measures of quantity of
IG/FB use (self-reported IG/FB intensity and observed weekly screentime use) and ADHD
symptoms. Given the relative stability of ADHD symptoms over time, 6-week timeframe may be
too short to see pathways between ADHD symptoms and quantity of IG/FB use. Unexpectedly,
higher self-reported daily screentime use predicted lower ADHD symptomatology 6 weeks later (after controlling for country of origin and ADHD symptoms at baseline). Existing literature has pointed to higher quantity of IG/FB use being related to more ADHD symptoms, not less (Khalis & Mikami, 2018; Ra et al., 2018). I speculate that this particular result in my study may reflect a spurious association, potentially due to aggregation of between-person and within-person variance within the CLPM. This finding was not documented in the other measures of quantity of IG/FB use in my study. In addition, within-timepoint correlations between ADHD symptoms and self-reported daily screentime use show a positive association rather than a negative one.

**Quality of IG/FB Use**

Participants who displayed higher quality of IG/FB use also reported higher ADHD symptomatology 6 weeks later. Although no other studies thus far have examined whether quality of IG/FB use prospectively predicts ADHD symptoms, this result conflicts with my initial hypothesis (informed by literature in in-person social settings) that poorer IG/FB experiences would predict increases in ADHD symptoms. As discussed above, the construct of quality of IG/FB use captured in this study may reflect the degree of positive self-presentation enacted by users on their IG/FB pages rather than the quality (e.g., warmth, closeness, supportiveness) of online social relationships.

This result for ADHD symptoms is similar to my findings that higher quality of IG/FB use predicted more internalizing psychopathology at later timepoints. Similar to the relationship between quality of IG/FB use and internalizing psychopathology, it could be that conforming to the pressure of posting idealized content when someone might not feel this way may be cognitively demanding, leading to an exacerbation of ADHD symptoms. Another possible explanation is that given the overlap between ADHD symptoms and internalizing...
psychopathology (Kooij et al., 2012; M. Weiss et al., 2011), particularly when measured using self-report questionnaires, my findings are capturing the impact of the quality on IG/FB use on the symptoms shared between ADHD and internalizing psychopathology such as difficulties concentrating and feelings of restlessness. These are also symptoms that are most likely to vary over a relatively short period of time (e.g., 6 weeks).

**IG/FB Use Mediating the Association Between Internalizing Psychopathology and ADHD Symptoms**

In an exploratory manner, I investigated whether aspects of IG/FB use (quantity and quality) might mediate longitudinal associations between internalizing psychopathology and ADHD symptoms. After controlling for ADHD symptoms at an earlier timepoint, there was a direct path from prior internalizing psychopathology predicting more ADHD symptoms later. This association points to a potential risk pathway between these forms of psychopathology. Some prior work has suggested that existing psychopathology may set the stage for the development of other forms of mental health difficulties both in adolescence and adulthood (Murray et al., 2022; Richards et al., 2022). This process may be particularly relevant during emerging adulthood, a developmental period during which individuals experience instability in environments and social relationships, making it a life stage during which young people are at greater risk for mental health difficulties (Arnett et al., 2014).

I note, however, that the opposite pathway between earlier ADHD symptoms and subsequent internalizing psychopathology was non-significant, which was somewhat unexpected given findings from existing literature (Tai et al., 2013). It may be that 6 weeks is insufficient time to observe how ADHD symptoms might predict internalizing psychopathology. Indeed, past
work has examined these processes over the course of years rather than weeks (Murray et al., 2022).

Crucially, the indirect effects (through quantity and quality of IG/FB use) in all models were non-significant. This runs counter to some evidence from in-person settings (Baumeister et al., 2005; Roy et al., 2015) and appears to contradict the cross-context continuity hypothesis, where we might expect processes from in-person settings to extend to the online domain. I speculate that despite social media such as IG and FB being an important context for emerging adults, it is not the only, nor the most important context in which individuals interact with others. Thus, the role of quantity and quality of IG/FB use in mediating the directional links between internalizing psychopathology and ADHD symptoms may be less significant than I had anticipated. I wonder if other processes not examined in the current study, such as in-person social functioning, may play a larger mediational role. Alternatively, if such mediational processes do exist, they might also unfold over a relatively longer timeframe.

**Secondary Findings: Country of Origin**

With the rationale that IG/FB use may be different for emerging adults who moved to Canada from countries where these platforms were banned (i.e., Iran, Syria, China, and North Korea), I included country of origin as a covariate in my analyses. Examination of the associations between country of origin and dimensions of IG/FB use revealed interesting findings. First, participants from countries in which IG and FB are banned engaged in lower quantity of IG/FB use (both when self-reported and observed). Although the participants themselves may be on these platforms now that they live in Canada, peers or family back home may not. Thus, there may be less motivation for these individuals to use them. Instead, these
emerging adults may find their time split between IG/FB and more localized social media platforms that are available in their country of origin, such as Weibo in China.

Second, participants who originated from countries where FB and IG are blocked also displayed lower quality of IG/FB use. Because participants from these countries did not grow up with these platforms and may have had less exposure to the norms surrounding their use, they may perceive less pressure to post positively-valenced content. Alternatively, the coding manual used may miss more nuanced expressions of positivity, connection, and emotional support on social media that are more common in their countries of origin but not in Canada.

With regard to IG/FB behaviours, participants originating from countries where IG and FB are blocked also reported engaging in less passive IG/FB use. Again, I wonder if this result from participants’ time being split between IG/FB and more localized social media apps in their country of origin. As the current study focused on IG and FB, I am unable to make conclusions regarding these participants’ passive social media use as a whole. Interestingly, social comparison behaviours did not appear to differ across country of origin. This suggests that perhaps the tendency to compare oneself to others on social media may not be a process that is limited only to FB and IG but could be a characteristic shared by social media platforms in general, particularly those that emphasize highly visualized and positively-biased content (Nesi et al., 2018).

**Cross-Continuity vs. Transformation Framework**

Although some associations between IG/FB use and psychopathology identified in my study seem to extend processes that occur in in-person settings (as theorized by the cross-context continuity hypothesis), others appear to be novel phenomena unique to the online social context, which aligns more with the transformation framework. On the one hand, I found that the
tendency to compare oneself to others online can predict increases in users’ internalizing symptoms. This aligns with work in in-person contexts, which posits that social comparison behaviours play an important role in developing and maintaining of depression and anxiety disorders (McCarthy & Morina, 2020). On the other hand, in my study, higher quantity and quality of IG/FB use predicted more internalizing symptoms rather than less, as would have been expected in in-person settings. This might suggest that the affordances and characteristics of the online social context transform some experiences. For example, it may be that the highly visual and permanent nature of content on IG/FB imposes a greater pressure on emerging adults to present themselves in a certain way which may be less present in in-person settings, leading to increased risk of internalizing psychopathology. I argue that while some aspects of social functioning might be continuous across contexts, other experiences and behaviours might be shaped by the unique context of social media like IG and FB.

**Study Strengths and Limitations**

The multi-timepoint longitudinal nature of the methodology represents a key strength of the study, which allowed for the testing of bidirectional associations between IG/FB use and psychopathology. Another strength includes the measurement of multiple aspects of IG/FB use beyond just how much time one spends on these platforms. Further, incorporating both participants’ self-reports as and observational measures in assessing dimensions of IG/FB use helped to improve the validity of the constructs and reduced concerns around shared method variance. The study sample also consisted of participants recruited from both HSP as well as the community at large, which may improve the generalizability of my findings.

Nonetheless, several limitations to this study warrant consideration. First, despite the longitudinal nature of the study, the length of time between timepoints and the time span of the
study in general may be unsuitable for assessing some hypotheses. Although the study length chosen was for practical considerations, 6 weeks may have been too short of a timeframe to measure changes in ADHD symptoms due to fluctuations in IG/FB use. Indeed, previous work examining the associations between ADHD symptoms and IG/FB use assessed these variables across months and years (Mikami et al., 2015; Ra et al., 2018).

Second, although I adopted a novel and methodologically rigorous approach to measuring quality of IG/FB by observationally coding participants’ IG/FB activity, I note some limitations in this methodology. As I only had access to participants’ IG and FB pages, I was unable to capture activity that occurred outside these contexts, such as private DMs with others on these platforms, content that was shared through DMs rather than on pages, and participants’ activity on their friends’ pages. Indeed, recent work has found that intimate communication between users is more likely to occur in DMs (through apps such as FB Messenger; Utz, 2015). Additionally, as the frequency of some indicators of quality of IG/FB use was low (e.g., deviant content), I was unable to include them in my analyses. Future investigations may benefit from observing the quality of users’ IG/FB use over a more extended period. It is also possible that certain facets of quality of IG/FB use may be prominent in more private channels on these platforms. For example, users wary of the permanence and availability of content on their public profiles may instead choose to share deviant content through DMs with trusted others.

Methodologically novel and ethical ways of examining users’ activity in both public and private IG/FB environments may be important for assessing quality of IG/FB use.

Third, from a model specification perspective, I acknowledge that during the initial implementation of the CFA for both the proposed latent IG/FB behaviours and quality of IG/FB use factors, the set of observed variables included in the analyses were treated as reflective
indicators rather than formative indicators. Misattributing indicators in this way can result in models that are misspecified, potentially leading to inconsistent parameter estimates (Bollen & Lennox, 1991). Both the proposed latent factors for IG/FB behaviours and quality of IG/FB use were ultimately dropped from analyses and thus did not impact my findings. However, this oversight highlights the importance of meticulous attention to detail in study design and analysis.

Fourth, the present study only examined participants’ IG and FB use. Although both of these platforms were the most popular social media applications at the time when data collection for the current study began, newer platforms such as Snapchat and TikTok have exploded in popularity over the last few years, particularly among emerging adults (Pew Research Center, 2021). Although they share many of the same characteristics as IG and FB, each offers distinct and unique features. Thus, the generalizability of my findings to social media use on other platforms may be limited. Even between FB and IG, users may be engaging with these apps in distinct ways and with different motivations. Future work may benefit from examining how the relationships between social media use and psychopathology may differ depending on what social media app is being used. In addition to other social media applications, emerging adults are increasingly turning to digital messaging applications such as WhatsApp and Facetime to communicate with friends and family. Therefore, my findings only capture a slice of participants’ total social activity online.

Fifth, although the passive IG/FB use measure used in the current study was adapted from an existing questionnaire that had previously been validated (Gerson et al., 2017), additional items were added to improve content validity and capture passive use on both IG and FB. This modified version would benefit from further psychometric validation.
Finally, there are several limitations related to the characteristics of the sample. As part of my inclusion criteria, participants were required to report having perceived at least some negative impact of their social media use on their life. Therefore, findings may not generalize to those with an entirely positive view of their social media use. The participants in my sample also predominantly identified as cisgender women (85%), and this was consistent across both community and HSP sub-samples. Although I found no gender differences in my outcome variables, the current results are likely more representative of the relation between IG/FB use and psychopathology among women. Further, although participants in my sample fell into the emerging adult (17-29) age group, a period characterized by instability in social networks and the formation of new relationships (Arnett, 2000), I recognize that there may also be variability within this age demographic with regards to not only the way they engage with social media like IG and FB but how the associations between the use of these platforms and psychopathology might play out. To the extent that there may be particular windows of vulnerability within the period of emerging adulthood, future research should examine how age might moderate the associations between IG/FB use and psychopathology.

**Clinical Implications**

Findings from this study underscore ways that IG/FB use may be related to psychopathology over time. This runs counter to previously held beliefs that interactions on social media are superficial and have little bearing on users’ offline lives (Orben & Przybylski, 2019). Such beliefs may lead treatment providers and policymakers to underestimate the role that social media use can play in users’ well-being and to ignore a meaningful component of emerging adults’ social lives.
My results suggest that in a non-clinical sample of emerging adults with elevations in psychopathology symptoms and who perceive social media to have some negative impact on their lives, certain experiences on IG and FB may prospectively predict higher internalizing psychopathology. Although my findings do not necessarily capture the experiences of people who meet clinical diagnostic criteria for a disorder, this study may aid treatment providers such as therapists in the community working with clients who struggle with psychopathology symptoms (but who may not have a formal diagnosis). Treatment providers might use these findings to inform more holistic case conceptualizations and to identify risk factors that may be exacerbating and maintaining clients’ difficulties. For instance, when working with a client with internalizing symptoms, it may be helpful during assessment and case formulation development to inquire about the amount of time they spend on social media like IG and FB and the degree to which they are engaging in social comparisons with others in their online network.

The directional pathways between aspects of IG/FB use and psychopathology raise possibilities for novel interventions employed in the online environment that can have downstream effects on improving mood and anxiety symptoms. It may be inadequate to advise emerging adults with elevations in psychopathology symptoms who perceive negative effects of social media on their lives to simply reduce time spent on social media (e.g., as suggested by Frost & Rickwood, 2017). Such a recommendation neglects to consider users’ behaviours and experiences on these platforms, and might be too challenging for some; a study found that the average FB user would require monetary compensation in excess of $1000 to deactivate their account for 1 year (Corrigan et al., 2018). Thus, I propose that interventions take a more nuanced approach, considering not only quantity but also behaviours and quality of use. For example, results from this study and previous research found that social comparison and feedback-seeking
behaviours are predictors of depression in both online and in-person contexts (Hames et al., 2013). Thus, I wonder whether interventions targeting these behaviours online (such as by encouraging individuals to unfollow or silence accounts that elicit social comparisons) might reduce internalizing symptoms. Another idea is that interventions could provide psychoeducation regarding the pressure for positive self-presentation on social media such as IG and FB, which could help users present themselves more authentically and potentially improve mood and well-being.

**Conclusion**

This study represents one of the first efforts to test the bidirectional associations between psychopathological difficulties (ADHD symptoms and internalizing psychopathology) and dimensions of IG/FB use. The present study highlights the complexity of the online social context and its importance to the well-being of emerging adults, in a sample screened for reporting elevations in psychopathology symptoms and perceiving at least some negative impact of social media use on their lives. It is important to note however that study findings may not generalize to users of other social media platforms, or to individuals who do not view their social media use as having negative effects on their lives. As digital platforms and communication tools continue to permeate the way we interact with others, it is crucial that we develop a more nuanced understanding of their intersection with our psychological well-being.


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https://doi.org/10.1016/j.appdev.2008.07.003


# Appendices

## Appendix A: Factor Loadings of Modified Passive Active Use Measure

<table>
<thead>
<tr>
<th>Passive Social Media Use</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reading or viewing something that a friend posted on their page without you commenting or liking it</td>
<td>.86</td>
</tr>
<tr>
<td>Reading or viewing friends’ Stories without sending them a message</td>
<td>.91</td>
</tr>
<tr>
<td>Reading the comments that a friend’s post has gotten, without you commenting or liking it</td>
<td>.83</td>
</tr>
<tr>
<td>Reading or viewing content from a page you follow without you commenting or liking it</td>
<td>.72</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Active Use on Participant’s own page</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posting pictures, videos, or status updates on your own page</td>
<td>.86</td>
</tr>
<tr>
<td>Posting Stories to your own page</td>
<td>.70</td>
</tr>
<tr>
<td>Reading other people’s comments or likes on content you posted on your own page</td>
<td>.86</td>
</tr>
<tr>
<td>Commenting on your own page – this includes responding to other people’s comments on content you posted on your own page</td>
<td>.86</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Active Use on Friend’s page</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Posting pictures, videos, or messages to a friend’s page (or posting to your own page but tagging a friend)</td>
<td>.74</td>
</tr>
<tr>
<td>Commenting on statuses, posts, pictures, videos, etc. that a friend posted on their page- this includes responding to the comments other friends have made on this post</td>
<td>.86</td>
</tr>
<tr>
<td>Liking or clicking on other emojis (love, laughing, surprised, sad, angry) for statuses, posts, pictures, videos, etc. that a friend posted on their page</td>
<td>.83</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Other Active Use</th>
<th>Factor Loadings</th>
</tr>
</thead>
<tbody>
<tr>
<td>Commenting on posts, pictures, videos, etc. that a page you follow has posted on their page- this includes responding to the comments other people have made on this post</td>
<td>.77</td>
</tr>
<tr>
<td>Liking or clicking on other emojis for posts, pictures, videos, etc. that a page you follow has posted on their page</td>
<td>.84</td>
</tr>
</tbody>
</table>
Appendix B: Quantity of Social Media Use Measures

Self-Report of Daily Social Media Use

*Thinking about the past 2 weeks, please indicate your estimated amount social media use per day:*

How much time in total per day do you spend on Instagram: _______ hours _______ minutes

How much time in total per day do you spend on Facebook: _______ hours _______ minutes
Social Media App Screentime Screenshot Script (Observed Weekly Use)

Participants will be directed to their built-in Screentime app (if using an iPhone) or will be asked to download the Screentime app (if using an Android device). Participants will be guided on how to navigate the app and will be provided the following instructions:

“We also would like you to let us know how much time you spend on social media over the next 6 weeks (during the study period). To do this, we are asking you to send us screenshots of this data from an app on your phone. If you use social media on your phone’s browser (aka Facebook on web browser as opposed to the app), we ask if you can use the app instead as this gives us a better idea of how much time you are spending on social media. Also please try not to update your phone during the duration of the study as it can alter this data.”

Participants will then be asked to take a screenshot of their Screentime app displaying the amount of time spent using Facebook and Instagram over the last 7 days. They will be instructed to send these screenshots by email to our lab email.
Multidimensional Facebook Intensity Scale – Modified
Adapted from Orosz et al., 2016

Thinking about your experiences while using social media in the past 2 weeks, please indicate your level of agreement with the statements below:

<table>
<thead>
<tr>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>NEITHER AGREE NOR DISAGREE</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
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<tbody>
<tr>
<td>1</td>
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<td>4</td>
<td>5</td>
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</table>

In the past 2 weeks...

1. If I could visit only one site on the internet, it would be Facebook or Instagram.
2. Going through Facebook or Instagram posts was good for overcoming boredom
3. I spent time on Facebook or Instagram at the expense of my obligations
4. I kept my Facebook or Instagram profile rather detailed
5. I felt bad if I didn’t check my Facebook or Instagram daily
6. When I was bored, I often checked Facebook or Instagram
7. I spent more time on Facebook or Instagram than I would like to
8. I liked refining my Facebook or Instagram profiles
9. I often searched for internet connection/data in order to visit Facebook or Instagram
10. If I was bored, I opened Facebook or Instagram
11. It happened that I used Facebook or Instagram instead of sleeping
12. It was important for me to update my Facebook or Instagram regularly
13. Before going to sleep, I checked Facebook or Instagram once more
Appendix C: Social Media Behaviour Measures

Passive Active Use Measure-Modified
Adapted from (Gerson et al., 2017)

In the past 2 weeks, how frequently have you performed the following activities when you are on Facebook and/or Instagram? (Note: Choosing “Very Frequently” means that about 100% of the time that you log on to Facebook/Instagram, you perform that activity).

<table>
<thead>
<tr>
<th>NEVER (0%)</th>
<th>RARELY (25%)</th>
<th>SOMETIMES (50%)</th>
<th>SOMEWHAT FREQUENTLY (75%)</th>
<th>VERY FREQUENTLY (100%)</th>
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<td>1</td>
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<td>3</td>
<td>4</td>
<td>5</td>
</tr>
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</table>

Thinking about the past 2 weeks, how often were you…

On your page:
1. Posting pictures, videos, or status updates on your own page
2. Posting Stories to your own page
3. Reading other people’s comments or likes on content you posted on your own page
4. Commenting (on statuses, posts, pictures, videos, etc.) on your own page – this includes responding to other people’s comments on content you posted on your own page

On friends’ pages:
5. Posting pictures, videos, or messages to a friend’s page (or posting to your own page but tagging a friend)
6. Commenting on statuses, posts, pictures, videos, etc. that a friend posted on their page- this includes responding to the comments other friends have made on this post.
7. Liking or clicking on other emojis (love, laughing, surprised, sad, angry) for statuses, posts, pictures, videos, etc. that a friend posted on their page
8. Reading or viewing something that a friend posted on their page without you commenting or liking it
9. Reading or viewing friends’ Stories without sending them a message
10. Reading the comments that a friend’s post has gotten, without you commenting or liking it

Other features:
11. Using Facebook or Instagram chat or messenger to send messages to friends
12. Managing events (creating, RSVPing, seeing who is coming)
13. Reading or viewing content from a page you follow (i.e. news, entertainment, businesses, celebrities) without you commenting or liking it.
14. Commenting on posts, pictures, videos, etc. that a page you follow (i.e. news, entertainment, businesses, celebrities) has posted on their page- this includes responding to the comments other people have made on this post.
15. Liking or clicking on other emojis (love, laughing, surprised, sad, angry) for posts, pictures, videos, etc. that a page you follow (i.e. news, entertainment, businesses, celebrities) has posted on their page
Social Comparison Rating Scale-Modified
Adapted from (Allan & Gilbert, 1995)

In the past 2 weeks, when I compare myself to others on Facebook or Instagram, I feel . . .

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<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
<th>10</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inferior</td>
<td>Superior</td>
<td></td>
<td></td>
<td></td>
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<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Incompetent</td>
<td>Competent</td>
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<td></td>
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<tr>
<td>Unlikeable</td>
<td>Likeable</td>
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<tr>
<td>Left Out</td>
<td>Accepted</td>
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<tr>
<td>Different</td>
<td>Same</td>
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<tr>
<td>Untalented</td>
<td>More talented</td>
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<tr>
<td>Weaker</td>
<td>Stronger</td>
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<tr>
<td>Unconfident</td>
<td>More confident</td>
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<td></td>
<td></td>
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<tr>
<td>Undesirable</td>
<td>More desirable</td>
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<tr>
<td>Unattractive</td>
<td>More attractive</td>
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<tr>
<td>Outsider</td>
<td>Insider</td>
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</table>
Iowa-Netherlands Comparison Orientation Measure-Modified
Adapted from (Gibbons & Buunk, 1999)

Most people compare themselves with others on social media from time to time. Please think about your experiences while using Facebook and/or Instagram in the past 2 weeks. Indicate how much you agree with each of the statements below:

<table>
<thead>
<tr>
<th>STRONGLY DISAGREE</th>
<th>DISAGREE</th>
<th>NEITHER AGREE NOR DISAGREE</th>
<th>AGREE</th>
<th>STRONGLY AGREE</th>
</tr>
</thead>
<tbody>
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<td>1</td>
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</table>

In the past 2 weeks, when I was on Facebook or Instagram …

1. I often compared how my loved ones (boyfriend or girlfriend, family members, etc.) are doing with how others are doing
2. I always paid a lot of attention to how I do things compared with how others do things
3. If I wanted to find out how well I have done something, I compared what I have done with how others have done
4. I often compared how I am doing socially (e.g., social skills, popularity) with other people
5. I was not the type of person who compares myself often with others
6. I often compared myself with others with respect to what I have accomplished in life
7. I often liked to talk with others about mutual opinions and experiences
8. I often tried to find out what others think who face similar problems as I face
9. I always liked to know what others in a similar situation would do
10. If I wanted to learn more about something, I tried to find out what others think about it
11. I never considered my situation in life relative to that of other people
Appendix D: Quality of Social Media Use

Facebook/Instagram Coding Manual

UBC Instagram-Facebook Coding Manual

Last Revised December 19, 2019
By Amori Mikami and Adri Khalis
PREPARING THE INFORMATION FOR CODING

(Done by the Lab Coordinator)

Friending and Following

Determine whether each participant is an active user of Facebook, Instagram, or both. Active user is defined as checking at least once a day. If both platforms, determine which platform the participant says is his/her primary one. Indicate this information in the tracker.

For each platform on which the participant is an active user, send a request to friend (Facebook) or follow (Instagram) the participant using a study page associated with each platform. If the platform requires the participant to accept the friend or follow request before we can see the profile, monitor whether the participant has responded to the request and send reminders if no response. For the psychology Human Subjects Pool participants, we will try to friend/follow them at their first study visit to the lab.

Once you are friends with/following the participant, use the study page associated with the correct platform to find the participant’s profile and their recent posts on their page. Note that on Instagram there is a tab for posts the participant has made, and a separate tab for posts the participant has been tagged in, whereas on Facebook this all appears on the same participant page. To check if the participant has an active story, in Instagram this will be indicated by a pink ring around the participant’s profile picture; alternatively, you can see this in the top row of your news feed from the study page. In Facebook you will need to look at the top row of your news feed on the study page to see if the participant has an active story.

Taking Screenshots of the Participant

In order to help coders know who the participant is and what the participant looks like, you will take some screenshots to identify the participant (for instance, of this person’s profile picture or other photos containing the participant). You will put these in a folder marked “Reference”.

Taking Screenshots of Posts During the Coding Period

The coding period covers the 14 days previous to the time you are accessing the page. So if you are accessing the page October 14 2019 at 2p.m., the coding period is October 1 2019 at 2p.m. through the present. Write the date and time that the coding period began and ended in the participant tracker.
For each coding period, you will take and save screenshots of the content on the participant’s profile in a folder. This includes posts during the coding period, as well as of any active stories at the time when you access the page. You will capture all the posts present during the 14 day coding period unless there are more than 20 posts. If there are more than 20 posts, you will capture the most recent 20.

Record on the tracker the total number of posts there were during the coding period, and the number you captured; these two numbers will be the same if 20 or fewer posts were made in the coding period. Record in the tracker whether or not there was an active story, so we know that this wasn’t just missed information if no story was captured. In Instagram, you can see the total number of posts this person has made in the history of the profile next to the number of followers; also enter this number in the tracker (on Facebook the total posts is N/A because it would take too long to count).

Save the screenshot capture of each post with the name “XXX #” where XXX is the participant ID and # is the post number. Sometimes the same post requires several screenshots to capture all the comments, in which case the name of each post should be XXX #.1, XXX #.2, etc. To determine the post number, 1 indicates the post that is the oldest in the coding period, then proceed with consecutive numbers up through the most recent post in the coding period. If there is an active story at the time that you are preparing the screenshots, then the story is always considered the most recent post.

Things that go in the footer of each screenshot capture of each post:

- Post number: even though this is in the title of the screenshot, put it again in the footer
- Group number: Sometimes participants post multiple pictures and link them together, so a viewer can scroll through them, or put multiple pictures in a collage and then post the collage. In this situation, you count each picture as a separate post, but indicate in the footer that they are linked together as part of a group. Similarly, sometimes participants have multiple posts in an active story. Again in this situation, you count each post in stories as a separate post, but indicate in the footer that they are linked together as part of a group. If the post is part of a group, also complete the group number and the number of the post in that group. Otherwise put N/A for these categories.
- Date of post: put the month, day, and year the post was made.
- Participant initial post: If the initial post was made by the participant, whether or not there is a caption, put 1 here. Otherwise put 0. In most cases this will be 1.
- Number of participant comments: Do not include the post itself and any captions of the post, even if the initial post was made by the participant. Count comments whether they are pictures, words only, or picture + words. Count comments whether they are new comments or replies to other people’s comments.
- Friend initial post: If the initial post was made by a friend, whether or not there is a caption, put 1 here. Otherwise put 0. On Instagram this occurs because a friend makes a post and tags the participant. On Facebook this could occur because a friend makes a post and tags the participant, or because a friend posts directly on the participant’s page.
- Number of friend comments: Do not include the post itself and any captions of the post, even if the initial post was made by a friend. Count all friend comments together, even if they are from different friends.
- Number of friend likes: record the number
- Whether the post is on the page or in stories

If a participant combines several posts into a group (for example, several pictures in one group), on Instagram it is only possible to comment on or like the whole thing as opposed to the individual posts. In this situation, put all the comments and likes on the screenshot of the first post, and then write N/A for these questions for the rest of the posts that make up the larger group.

On Facebook it is possible to comment or like the whole thing, and also on individual pictures that are part of a group, but most friends’ comments tend to be on the whole thing. Sum all the comments/likes on the whole thing with all comments/likes on the first individual post, and then report the sum for the first post in the group. For the rest of the posts in the group, count the likes and comments that are on each individual post.

If the participant is an active user of both Facebook and Instagram, you will take screenshots of both platforms even though you will record in the tracker which is the primary platform. Coders will note whether posts are the same on both platforms on the coding sheet.

**Number of Social Media Friends**

Record current friends in the Number of Social Media Friends section on the tracker.

**Instagram**

Record the number of followers the participant has and the number the participant is following. You can find this information at the top of the profile. Then select N/A for Facebook friends.

**Facebook**

Record the total number of friends. There should be a box with the word “Friends” in the row under the cover photo. Clicking on that box usually yields the total number of friends listed at the top and this should be captured in the screenshot. Some participants hide their friend list, in which case you would not be able to view the total number of friends and would be restricted to only seeing mutual friends. If this happens, write unknown. Also select N/A for Instagram number of followers and number following.
CODING THE PROFILE
(Done by RAs)

Setting Up

Write the participant ID and your name in the header of the coding sheet.

From the tracker, find whether you are coding the participant on Instagram or Facebook or both. Find the screenshots of the participant’s profile and stories which have been prepared for you by the lab coordinator (or if no story, that will be noted in the tracker).

There will be a folder called “Reference” that contains pictures to help you know who the participant is (what they look like). You do not code the posts in the “Reference” folder. They are just there to help you identify the participant in the posts you are coding.

Social Media Activity

You will log each post during this 14-day coding period made by the participant or made by friends on the participant’s page or tagging the participant. Start with the post that was made the longest time ago within the coding period which will already be labelled “1” for you.

If the participant has both an active Facebook and an active Instagram page, then check if the same post is on both platforms. If it is, then record the post number that it is on the other platform. If it is not on the other platform (or there is no other platform) then record N/A for the section asking about the post number on the other platform.

A post is considered to be a single picture, video, verbal expression, or sharing a link, which appears on the participant’s page or in stories. Any caption that may be on the post is included as part of the post. Captions are usually at the top of the post on Facebook and at the bottom of the post on Instagram. Some users will also put captions in the picture or video itself (e.g., written in text on the picture as opposed to in the caption section under the picture).

Comments from the participant or friends on the post typically appear below the initial post and below any caption. These are recorded in the section about comments, and are not considered to be separate posts. On Facebook, comments can either be pictures or words, and they can be new comments or replies to other comments. In all situations, just consider each one a comment. On Instagram, comments can only be words and are all new comments. Similarly, each one is considered to be one comment.
Whether the initial post was made by the participant or by the friend, and the number of comments from the participant and from friends, should be already indicated for you by the lab coordinator on the screenshots in the footer.

Sometimes participants post multiple pictures and link them together, so a viewer can scroll through them, or put multiple pictures in a collage and then post the collage. In this situation, count each picture as a separate post, but indicate on the coding sheet that they are linked together as part of a group. Similarly, sometimes participants have multiple posts in their active story. Again, count each post in stories as a separate post, but indicate on the coding sheet that they are linked together as part of a group. This should already be indicated for you by the lab coordinator on the screenshots.

Record the date of the post on the coding sheet. Then record whether the post was made on the page or in stories. This information should be in the footer of the screenshots for you.

Note that both participants and friends can post on the participant’s page, but only the participant can post in the participant’s story. Facebook friends’ posts show up on the participant’s page either because the friend posted directly on the page or because a friend posted on their own page but tagged the participant. Instagram friends’ posts show up because the friend posted on their own page but tagged the participant. Record who made the initial post, the participant or a friend. This should also be in the footer of the screenshots.

You will use a fresh page on the coding sheet for each new post.

For each post the participant made, record:

(a) Whether the content of the post is *participant-created* (the participant is posting content that we assume the participant made or was directly involved in the making), *friend-created* (the participant is sharing content assumed to be created by someone the participant knows or with whom the participant has a relationship), or a *meme* (the participant is posting content assumed to be created by someone the participant does not know personally).

- **Participant-created examples:** the participant posts pictures or videos that we assume the participant took or someone in a group with the participant took. The participant does not have to be the one taking the picture as long as the participant was involved in creating the content (as opposed to in a picture or a video that is a meme, where the participant had nothing to do with the creation of the content). So, a picture we assume the participant took of the UBC campus counts. So does a selfie of the participant and friend where the friend is holding the camera, or a picture of the participant taken by someone else – so long as the participant is posting this pic on his/her page, as opposed to sharing a post of this pic that a friend posted. A status update containing only words that we assume the participant wrote is also participant-created content. If a participant took a buzzfeed quiz or got a high score in an online game and posted his/her personal results, this is also participant-created because the focus is on the participant’s personal score, even though the participant did not write the quiz/game itself.
- **Meme examples:** political statements or infographics (not written by the participant), cartoons (not drawn by the participant), funny cat pictures or videos...
(assumed to be found on the internet, and not taken by or containing the participant or anyone the participant knows), sharing a link to an article the participant did not write (e.g., sharing a story in The Onion) or to a video the participant did not create (e.g., a movie trailer). In all cases we assume the participant does not know the creator of the content and has no involvement or personal relationship with the creator of the content.

- Friend-created content examples: The friend has made a post on the friend’s page, and then the participant shares it on his/her own page. We assume the participant and the friend have some type of personal relationship or involvement. For example, the participant shares a friend’s post containing a cupcake picture and writes the caption “working as a taster for @friendname, best job ever”. Or, participant shares a friend’s post that contains a video that has the participant and the friend in it (participant may be tagged in the video). Another example is the participant shares a friend’s post and the participant adds the caption “congratulations to @friendname for finishing her first half-marathon”. In these examples the caption, the tag, and/or seeing the participant in the friend’s video, tells you that the participant and the friend know one another.

- If a participant shares a post from a social media user, but does not make a comment to indicate that s/he knows the user nor is there anything in the user’s post to show that the user knows the participant, then assume it is a meme and not friend-created content.

- One tricky situation is that a profile that is an organization such as “UBCRec” or “Koerner’s Pub” may not be associated with a specific person who is a friend of the participant. However, if this profile has posted a picture that tags the participant, and the participant shares it, then consider it friend-created content. The point of a meme is that there really is no personal connection between the participant and the creator. However, if UBCRec or Koerner’s Pub posted a picture that did not have the participant in it, and the participant shared it, assume it is a meme. This is because without a tag of the participant, you do not know if the participant has any relationship at all with the organization.

- Another tricky situation is if a participant shares a friend’s post, but the friend has posted a meme. It is clear from the captions that the participant has a personal relationship with the friend whose post the participant is sharing. This is friend-created content, because that is what the participant has shared (the friend’s post).

- Some participants will post a meme and then write a caption that makes it personal. For instance, the participant might post a picture of an event and write “dying to go to this.” This is still a meme, however, but the caption factors into the section about content of posts.

(b) Whether the type of post is a picture, a video, or words only (all text).

- Think about what the main point/main content is of the post.
- Sometimes there are words written on a picture or a video as a caption. The post type in this case is still picture or video, because that is the main content.
- Words only refers to all text, such as a status update on Facebook. Some participants may post a picture that contains all text, which happens more on Instagram because on this platform it is not possible to just write text. This is also coded as words only, because that is the main content.
• Sharing a link to a news story or online quiz (which is a meme) will sometimes have a picture associated with the link. However, this is also words only because the picture is not important to the content of the link.

(c) The number of comments the participant has made on the post. This should be recorded for you in the footer, but these reflect any additional comments made by the participant in the comments section (not counting captions).

(d) The number of likes that post has received (do not count likes on comments). This should already be recorded for you by the lab coordinator in the footer.

(e) The number of comments that friends have made on that post. Again, this is recorded for you by the lab coordinator in the footer. Count all friends’ comments together even if they are not the same friend.

On Instagram, if a participant posts several pictures in one larger post, it is only possible to comment on or like the whole thing as opposed to the individual pictures. In this situation, put all the comments and likes on the coding sheet for the first post, and then code N/A for these questions for the rest of the posts that make up the larger post. This is recorded for you by the lab coordinator in the footer.

On Facebook it is possible to comment or like the whole thing, and also on individual pictures that are part of a group, but most friends’ comments tend to be on the whole thing. Sum all the comments/likes on the larger post with all comments/likes on the first individual post, and then report the sum on the first post in the group. For the rest of the posts in the group, count the likes and comments that are on each individual post.

For each post that a friend has made on the participant’s page, record:

(a) Whether the content of the post is participant-created, friend-created, or a meme.

• As the friend initiated the post, most of the time the content is friend-created (e.g., created by the poster). However, if the posting friend shared content from the participant (and potentially tagged the participant in it), this would be participant-created content. If the posting friend shared content that we think was created by someone the friend knows personally who is not the participant, this is friend-created content (even though it is a different friend). If the posting friend shared content that we think was created by someone the friend does not know personally, this is a meme.

(b) Whether the type of post is a picture, a video, or words only (all text).

(c) The number of comments that the participant has made on the post. These would be in the comments section as the friend initiated the post.

(d) The number of likes that post has received (do not count likes on comments).

(e) The number of comments that friends have made on that post. This does not include the initial post or the caption that was made by the posting friend. This reflects additional comments in the comments section made by friends. Count all friends together even if they are not the same friend who made the post.

If a friend posts several pictures as part of a larger post, handle this the same way as you do when a participant does this.

For each post the participant has made as part of an active story, record:
(a) Whether the content of the post is participant-created, friend-created, or a meme.
   • A common example of friend-created content is when the participant clicks “add to story” to put a post from a friend’s page in the participant’s story.
(b) Whether the type of post is a picture, a video, or words only (all text).
   • In a story, words only is always a picture that only contains text.
(c) Because you cannot comment on or like stories, this is an automatic N/A for participant comments. This is true whether or not there is a caption on the post, because the caption goes with the original post.
(d) Similarly, the number of likes the post has received is N/A.
(e) The number of friend comments is also N/A.

Content of Posts

Consider the past 14 days of activity (the coding period). Each post noted in the previous section will be coded for its individual content. Code content for each post, even if the post is part of a larger group. *You are considering all the information in a post, which includes the content in the initial picture/video/words/friend-created/meme, any caption on the post, and all comments on that post, to get a global impression of what the post is communicating.*

Recall that on Instagram, posts in a group on the page have one caption that will be under each of the posts in the group (although it is possible to write individual captions on the pictures themselves). Likes and comments for the whole group will be the same under each one of the posts in the group. On Facebook, there can be one caption for the entire group, and then different, individualized captions under each picture (plus, individual captions can be written on the pictures themselves). There can be likes and comments for the entire group, as well as likes and comments for each one of the individual posts in the group.

• When counting likes and comments, in Instagram we handled this situation by putting all likes and comments for the group on the first post in the group and making likes and comments for all other posts in the group N/A. In Facebook, we put all likes and comments for the group on the first post in the group and added them to any likes and comments made on the first post. Then we recorded the likes and comments on each of the other posts in the group individually.

• Now we also must consider captions and comments that are on the group to inform the codes below. In Instagram, consider the caption and comments for the group to apply to the first picture in the group. For the remaining pictures in the group, only consider new captions that are specifically written on the individual picture; do not use the caption and comments for the group to provide information about pictures in the group beyond the first picture, even though you will see the captions and comments appear below all pictures in the group. In Facebook, consider the captions and comments on the group to provide information about the first picture in the group (including any caption and comment on the first picture itself). For subsequent pictures in the group, only consider the captions and comments on that picture.

Codes
(a) Is the participant expressing positive affect? The tone of the post is positive, upbeat, sharing good news or accomplishment or the participant states s/he is having fun. (e.g., “vacation here I come!!!!!!! 😊😊”). Or, the participant has a big smile on his/her face that looks genuine. If you cannot see the participant’s face in the pic, then you need an indication from the caption or comments that the participant is having a good time. The participant is giving the impression that he or she is probably having a good time (medium) or having an awesome time (high). You would imagine the participant saying with this post, “life is good”. Because of social norms on social media, the typical post that seems basically upbeat and where the participant seems happy will probably be “medium”. More intense expressions of positive emotion will raise the score to “high.” Only code things that the participant did (not friends).

• If the participant is hugging someone, or they have their arms around each other, in the absence of being able to see their faces or a caption or comment to explain their affect, assume this is medium.
• If the participant shares an upbeat meme (like, overly adorable puppies) but does not write a comment or caption, this is positive affect but is a max medium. It can only be high if the participant relates personally feeling positive affect around the meme or by watching the meme.  
• If the friend made the post, you can code positive affect if the post contains a picture of the participant (who is showing positive affect in the pic), or if the participant leaves a comment communicating positive affect. Only code things that the participant contributed (not friends).

(b) Is the participant expressing negative affect? The tone of the post expresses some type of negativity. This could be sadness, anxiety, irritability, or anger. Medium is for any expression of negative emotion, and high is for a more intense expression. You think with “medium” that the participant is not that upset and will get over it soon, but you are noting its presence. With “high” this seems like a significant expression of negativity, such as “midterm tomorrow, freaking the freak out.” Or, the participant is sharing negative content that is personal such that you think any typical person would be quite upset, even if the participant does not sound upset, such as “found out tonight I was cheated on, oh well good riddance c’est la vie.” Only code things that the participant did (not friends).

• The difference between negative affect and call for emotional support is that expressing sadness or anxiety is usually both. However, call for emotional support can also be a statement like “have my job interview tomorrow” without expressing anxiety. And, a statement like “44 bus late again- annoying” would be negative affect (medium) but not call for emotional support because it doesn’t seem like something that social media friends would offer comfort about.
• If the participant shares a sad meme or an opinion with sad content (like, information about all the endangered species that have died off, or about how animals in the meat industry are slaughtered) but does not write a comment or caption to express how s/he personally feels about it, this is negative affect but is
a max medium. The key here is that it doesn’t personally apply to the participant, it is more of a political statement or a statement about the world. It can only be high if the participant relates personally feeling negative affect around the meme or by watching the meme, such as “what a sad, sad world we live in”.

- If the friend made the post, you can code negative affect if the post contains a picture of the participant (who is showing negative affect in the pic), or if the participant leaves a comment communicating negative affect. Only code things that the participant contributed (not friends).

**Relationship Quality**

Consider the past 14 days of activity (the coding period). Each post noted in the previous section will be coded for its individual content. Code content for each post, even if the post is part of a larger group.

**Codes**

For each code below, record the number of times that code is present on the post for participant content and for friends’ content. Participant content can include the initial post (including any caption), and any comments. Friends’ content can include the initial post (including any caption), and any comments.

- Recall that when considering captions for posts in a group, the caption that is for the entire group is only considered to apply to the first post in the group and not to the remaining posts in the group.

On the coding sheet, record the number of potential opportunities for the participant to get each code from him/herself (participant) and from friends. If the participant made the initial post with a caption, then made 2 comments below, and friends made 3 comments below, then the totals would be:

<table>
<thead>
<tr>
<th>Number Possible</th>
<th>Participant Initial Post (+ Caption)</th>
<th>Participant Comments</th>
<th>Friend Initial Post (+ Caption)</th>
<th>Friend Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Connection</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Call for Emotional Support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional Support Given - Low</td>
<td></td>
<td></td>
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<tr>
<td></td>
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</tr>
<tr>
<td>High</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Call for Instrumental Support</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrumental Support Given</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviant Content</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Aggression</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
Then, proceed to record the number of those opportunities in which each code was demonstrated. If the number possible is 0 in any column, then the rest of the codes going down that column will automatically be 0. Similarly, if the post is part of a story, then code 0 for potential opportunities for participant comments, friend initial post, and friend comments, as these categories are not possible in a story.

A single comment (or initial post) can receive multiple codes with the exception of low and high emotional support given. In the case of emotional support given, if a single comment has both low and high parts, it is simply coded as high emotional support. The way the coding sheet is created is meant to remind you of this.

(a) Connection – this captures a genuine relationship between the participant and one or more friends on social media, where they know each other beyond a superficial level. Unlike the previous codes about whether other people are in the pic/video or brought in verbally by the participant where it does not matter if the other person is a social media friend, connection must specifically be with social media friends.

- In pictures you are looking for tags of other social media friends of the participant to indicate connection. The one exception to this is if a friend was tagged in another picture in the same post group, and it is obviously the same friend, you can count this as connection in a later post within the same group.

- Connection can be shown in comments between participants and social media friends where they reference inside jokes, or hanging out together in the past or making clear plans to hang out in the future. So if the participant posts a picture of him/herself as a child with family members and says love my family, but doesn’t tag anyone, this is not connection. Similarly, if any friend commented and said “I remember that day...” that would be connection, but if a friend commented and said “cute pic” this would not be connection though it would be low emotional support given.

- Friends’ connection must be with the participant to count. For example, a friend posts a pic and tags the participant and we presume the friend who posted and the participant know each other or are together. Or, UBC rec posts a pic but the participant and other people are in it doing something together and all tagged, this is also connection. But, if UBC rec posted a pic of the participant by him/herself or only the participant is tagged in a pic posted by UBC rec this would not count as connection. This is because we do not think UBC rec is actually a “friend” the participant knows.

- If the participant has shared friend-created content to their own story, count connection for the participant post if the participant is in the friend-created content or tagged in that content, even if we know the friend did the original tagging. This is because the participant is validating that tag by sharing the content to his/her own story.

- Yes: Participant says “proud of @xxxx for completing his UBC degree!” and shares a post of xxxx’s graduation that xxxx posted.

- No: Participant shares a post that @yyyy created that is a political message and the caption is “sad but true”, or participant has no caption. This is not connection.
and probably is a meme since we are assuming participant does not know yyyyy personally.

- **No:** Participant shares a post that @zzzz created of a cute dog but it looks like a home video and @zzzz’s personal pet. The participant caption is “cuteness overload”, or participant has no caption. This is not connection and is also a meme, even though @zzzz may someone the participant knows, just because we aren’t sure. The one exception is if it is clear that the participant knows @zzzz from the same post group, then it becomes friend-created content and connection.

- **On Instagram** you can tell someone is tagged because their name will be by their pic, and there is a “tagged” logo in the lower left corner of the pic. On Facebook you will see the friend’s name in the caption as “with friendname” highlighted, or their name will be by their pic.

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(b) **Emotional support given** – In emotional support given in general, the poster offers kind words of support or says a nice thing about the recipient. Participant emotional support can be directed to a specific friend or to people in general. Friends’ emotional support given must be to the participant to be counted or to a group that includes the participant; if a friend directed emotional support only to someone who is clearly not the participant, do not count it. Note that although emotional support given often follows after a call for emotional support, it does not have to. A friend could give unsolicited emotional support to a participant (or vice versa).

- **Do not count** emotional support given when it is obviously an advertiser (e.g., the advertiser says “you look so cute, would love to see you in our product.”) who we assume does not know the participant; this is because the point of emotional support given is to further the relationship between the giver and the recipient, and this is unlikely to be the case with an advertiser. However, if a social media friend who is a hairstylist posts a pic of the participant’s new haircut and says “cute haircut” this would count as emotional support given because it does further the relationship between the friend and the participant (even if the friend is also doing this to promote her business) as in this case, the friend and participant have a relationship.

- **Low emotional support** are nice things and expressions of well-wishes that you could say to someone you didn’t know very well, like “you look nice”, “congratulations!”, “good luck tomorrow”, “I hope your move goes well”, “miss ya”, or “xoxo”. Heart or applause emojis are usually low emotional support if they are sent to the participant. In a situation where the participant posts a pretty picture of the beach, do not count a heart emoji in a friend’s comment if it seems like the friend is saying that she loves the picture or loves the beach as opposed to that the friend is sending love to the participant or to how the participant looks.

- **Relative to the low code,** high emotional support exemplify strong messages of support or validation or love, and are usually things that would only be said to a close friend and not an acquaintance. Examples are “you are amazing” “you’re an inspiration to me”, “I respect you a lot”, “I love you”, “you are such a great friend”, “you’re my best friend”, or “you are so strong and capable and I know
you can do it”. Emojis alone are typically not enough to be high emotional support and are probably low.

- Again, if a single comment has both low and high components, it just gets one score for high.

(c) Deviant content – the poster uses profanity that is not acceptable on network TV, has any sexual content, or nudity, or illegal behaviours (illegal drug use, vandalism) or excessive use of legal drugs (e.g., reference to drunkenness, drinking games, keg stand pictures – but not a picture where participant is holding a glass of wine or a beer as this would probably be considered to be socially appropriate).

- In general you are looking for things that might be considered to indicate poor judgment by a potential employer.
- Friends’ deviant content does NOT need to involve the participant or be addressed to the participant to count.

(d) Verbal aggression – the poster gives a put down, insult, or criticism to the recipient. Poster can also be mocking the recipient, like making fun of the participant’s grammar/spelling, behaviours, life, etc. Look for if the result of the comment is to belittle the recipient. It can be hard to determine if things are a “joke” in the online context but take it literally at face value.

- If the participant makes the post, you are looking for the recipient to be someone in the participant’s social media circle or who would likely find out about it or be known by others in the participant’s social media circle. So, if the participant complains about the bus driver or the call center guy, this is negative affect but not verbal aggression because it is not directed at a friend or at someone who is in the participant’s social circle, or that the participant knows, or who would have a reasonable probability of seeing it on social media or hearing about it.
- Friends’ verbal aggression must be directed to the participant to be counted. If a friend directs verbal aggression to another social media friend who is not the participant, this does not count.
This is a screenshot of a post on an “open to the public” profile.

Post content is friend-created because the participant is sharing a friend’s content in her story (even though, the friend’s content is a pic of the participant plus a caption the friend wrote). The post type is a picture (even though there is a verbal caption on it). Because it is in a story, the participant comments, likes, and friend comments are all N/A.

The participant does not use words to relate the post to her life, but she does draw someone else in by her caption at the bottom (you’re 27/16 as cools) which is meant to address @itstommibitch.
Because @itstommibitch is a social media friend, this is connection. It is also low emotional support given because of the participant caption. Even though the participant is posting friend-created content that is giving connection and low emotional support to the participant, this is a participant post so there is no opportunity for friend content to be coded.

Some of the key codes from the coding sheet are below.

Social Media Activity

Where posted: Page Stories
Who posted: Participant Friend
Post content: Participant-created Friend-created Meme
Post type: Picture Video Words only
Number of participant comments: ________ N/A
Number of likes received: ________ N/A
Number of friend comments: ________ N/A

Content of Post
Participant in a pic/video that is participant- or friend-created: Yes No N/A
Other people in a pic/video that is participant- or friend-created: Yes No N/A
Participant uses words to relate the post to his/her life: Yes No
Participant uses words to relate the post to anyone else: Yes No
Overall focus of post (>50%): Participant Participant and Others Others Neither
Participant positive attention to appearance: Low Medium High
Participant positive attention to possessions/accomplishments: Low Medium High
Participant positive affect: Low Medium High
Participant negative affect: Low Medium High

Relationship Quality of Post
<table>
<thead>
<tr>
<th></th>
<th>Participant Initial Post (+ Caption)</th>
<th>Participant Comments</th>
<th>Friend Initial Post (+ Caption)</th>
<th>Friend Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number Possible</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Connection</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Call for Emotional Support</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Emotional Support Given - Low</td>
<td>1</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>- High</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Call for Instrumental Support</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Instrumental Support Given</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deviant Content</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Verbal Aggression</td>
<td>0</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
ETHICAL ISSUES

Knowing the participant

You may know the participant who we assign you to code. It is possible that you won’t realize that you know the participant until you get onto his/her page, but as soon as you realize this, you need to tell Luke so you get reassigned. This is also the case if you realize that you don’t know the participant, but you know his/her friends that s/he interacts with on social media, or the two of you are part of the same club at UBC, or really any scenario where you think it’s likely that the two of you will come into contact even if you haven’t already. You cannot code this person because (a) it will be hard for you to be objective about them; and (b) to be fair to the participant, s/he may not want someone that s/he knows coding his/her page.

Talking about things you see on participant’s pages

Simple rule- don’t do it unless the people you are talking to are part of our RA team. Say you see something on a participant’s Facebook page that you think is hilarious. You can (a) show and tell Adri or Luke who will probably appreciate the laugh; (b) show and tell anyone else on the RA team for this study. Do not show or even tell other friends of yours, even if you think the friends of yours do not know the participant, and even if you never name the participant by name. This is out of respect for the participant. As well, you never know who knows whom. You could be talking about this “totally sad thing” you saw on someone’s page, and then your friend might actually know who you are talking about even if you don’t name the participant by name, or your friend could tell someone else who does know the participant.

Danger to self or others

It is unlikely that this will happen, but if you do run across anything where a participant seems to be threatening harm to self or others, even if you think the person is joking, you need to tell a staff member (Luke, Adri, Dr. Mikami) immediately. This is so that we can determine whether we think we need to follow up to get the participant help. What counts here are threats to kill oneself/make a suicide attempt OR to kill/attack/physically harm someone else who is specifically named. You do NOT need to report deviant content involving drug and alcohol use, vandalism, theft, etc. However, if you are not sure whether you should report something, do so and let us determine whether we need to follow up.
Appendix E: Psychopathology Measures

Depression Anxiety and Stress Scale (Short-Form)
S. H. Lovibond & Lovibond, 1995

Read each statement and select the number which applies best to you in the past 2 weeks.

<table>
<thead>
<tr>
<th>Did not apply to me at all</th>
<th>Applied to me to some degree, or some of the time</th>
<th>Applied to me to a considerable degree, or a good part of the time</th>
<th>Applied to me very much, or most of the time</th>
</tr>
</thead>
<tbody>
<tr>
<td>0</td>
<td>1</td>
<td>2</td>
<td>3</td>
</tr>
</tbody>
</table>

Over the past 2 weeks…

1. I found it hard to wind down
2. I was aware of dryness of my mouth
3. I couldn't seem to experience any positive feeling at all
4. I experienced breathing difficulty (e.g., excessively rapid breathing, breathlessness in the absence of physical exertion)
5. I found it difficult to work up the initiative to do things
6. I tended to over-react to situations
7. I experienced trembling (e.g., in the hands)
8. I felt that I was using a lot of nervous energy
9. I was worried about situations in which I might panic and make a fool of myself
10. I felt that I had nothing to look forward to
11. I found myself getting agitated
12. I found it difficult to relax
13. I felt down-hearted and blue
14. I was intolerant of anything that kept me from getting on with what I was doing
15. I felt I was close to panic
16. I was unable to become enthusiastic about anything
17. I felt I wasn't worth much as a person
18. I felt that I was rather touchy
19. I was aware of the action of my heart in the absence of physical exertion (e.g., sense of heart rate increase, heart missing a beat)
20. I felt scared without any good reason
21. I felt that life was meaningless
Current Symptoms Scale
Barkley & Murphy (1996)

Please select how much each description has applied to you in the past 2 weeks.

<table>
<thead>
<tr>
<th>NEVER or RARELY</th>
<th>SOMETIMES</th>
<th>OFTEN</th>
<th>VERY OFTEN</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>2</td>
<td>3</td>
<td>4</td>
</tr>
</tbody>
</table>

In the past 2 weeks…

1. I didn’t pay close attention to details, so I would make careless mistakes in my work
2. I tended to fidget with my hands, tap my foot, or squirm in my seat when I was sitting down
3. I had difficulty keeping my attention on things, for instance, if I was doing schoolwork or in a lecture my mind would wander
4. I wanted to get up and leave my seat in situations when I was expected to stay in my seat
5. I tended to not listen when people were talking to me because I was daydreaming or thinking about something else
6. I felt restless and wanted to get up and move about when I was supposed to sit still or wait for things
7. If I got a multi-step instruction for a class assignment, it would be hard for me to remember to follow through on all the steps, and I might leave the work incomplete
8. I had trouble not being loud when I was having fun, even in situations when I was supposed to be quieter
9. I had difficulty organizing things and staying organized about things such as my room, work schedule, class notes, or school assignments
10. I was always on the go and rushing about from one thing to another, as if I was "driven by a motor"
11. I avoided, disliked, or put off (procrastinated doing) anything where I would have to concentrate for a long time or put in sustained mental effort
12. I talked too much or talked in situations when I am not supposed to be talking
13. I lost things that I need for tasks, activities, or schoolwork
14. I had trouble waiting for people to finish asking a question before I jumped in with the answer
15. I got distracted easily by sounds, sights, or things around me
16. I had trouble waiting and got impatient, for instance while in line at the store or at the bus stop, or in traffic
17. I tended to forget what I was supposed to be doing, appointments I had made, or when assignments are due
18. It was hard for me to not interrupt other people when they were talking
Appendix F: Experimental Conditions

**Promoting Relationships in Social Media (PRISM) Tutorial Condition**

The PRISM tutorial was designed to help users engage more effectively with social media. The tutorial has three modules, each about 10 minutes in length. At timepoints 1, 2, and 3, participants in the tutorial condition will complete modules 1, 2, and 3 of the tutorial, respectively.

*Module 1:*
This module helps participants become aware of when social media use is making them feel happier versus when it is making them feel worse about themselves or their lives. The goal is for participants to make more informed, mindful choices about when they decide to check social media and which content/friends they decide to look at on social media.

*Module 2:*
This module addresses participants' tendency to make upward social comparisons when using social media. The goal is to provide psychoeducation regarding the extent to which friends selectively post interesting, fun activities while omitting boring or unattractive content.

*Module 3:*
This module aims to reduce participants' lurking (or passive use) and increase positive, active engagement on online social network platforms that will lead to increased social connection. The goal is to propose small steps for users to be more engaged such as by making an effort to like and comment on at least one friend's post. This module also encourages users to think about the way they come across to others on social media and also provides strategies to be more effective in interactions with others online.

**Fasting Condition**

Participants assigned to the abstinence condition will view videos and content that encourage them to abstain (or reduce as much as possible) from using their social media. The content will also explain why we think abstinence might be helpful and provide them with tips to keep up abstinence. Participants will be presented with new content and videos at each timepoint. The amount of time viewing content is meant to be matched in the three conditions (approximately 10 minutes per session).

**Control Condition**

Participants in the control group will view videos and content that provide what is intended to be interesting psychoeducational information about social media (such as demographics of users, statistics and trends, controversies) but that does not ask participants to change their personal pattern of use in any way. Participants will be presented with new content and videos at each timepoint. The amount of time viewing content is meant to be matched in the three conditions (approximately 10 minutes per session).
Appendix G: Consort Diagram

Human Subjects Pool (HSP) participants assessed for eligibility
\[ n = 21667 \]

Excluded \( (n = 15363) \)
- Outside age range \( (n = 431) \)
- Not daily user of social media \( (n = 1745) \)
- Reported positive or no impact from social media use \( (n = 6497) \)
- Below psychopathology symptom threshold \( (n = 5224) \)
- Missing information \( (n = 1466) \)

HSP participants invited to participate
\[ n = 6304 \]

HSP participants included in study
\[ n = 270 \]

Community participants assessed for eligibility
\[ n = 1252 \]

Excluded \( (n = 831) \)
- Outside age range \( (n = 60) \)
- Not a Canadian resident \( (n = 129) \)
- Not daily user of social media \( (n = 98) \)
- Reported positive or no impact from social media use \( (n = 308) \)
- Below psychopathology symptom threshold \( (n = 226) \)
- Missing information \( (n = 10) \)

Community participants invited to participate
\[ n = 421 \]

Community participants included in study
\[ n = 129 \]

Total recruited
\[ n = 399 \]